THE

WORLD OF WONDERS:

ings Wonderful in Nature, Science, and Art.

CASSELL, PETTER & GALPIN:

LONDON, PARIS & NEW YORK.

the time of the birth of Moses, or nearly four thousand years ago, he would as yet have accomplished only half his journey !"

The sun, which so many have worshipped, and which is, humanly speaking, the source of life to us all, is another perpetual wonder. Its circumference is about 2,770,000 miles. Its distance from the earth is so great that a railway train moving at 32 miles per hour would take three millions of hours, or three hundred and forty-two years and three months, to travel from London to the sun, supposing that it could travel incessantly night and day during that time. A cannon-ball, moving fifty times faster than such a train, would expend seven years in reaching it. To make a globe like the sun, it would take 1,400,000 globes like the earth rolled into one? Or, to make these facts simpler, and yet more stupendous, the bulk of the sun is five hundred times greater than the aggregate bulk of all the other bodies of the solar system of which night only reveals to us a small part—that which appears above our hemisphere, and above our particular stand-point. The centre of the sun is a dark mass covered with a garment of flame. But in this luminous matter there are vast rents. We talk of spots in the sun; spots indeed! the space occupied or laid bare by the principal spot is 928,000,000 square geographical miles. Arago, by a physical test, proved that this garment of flame, this luminous matter, must be gaseous; so that the sun floats in an ocean of flame, and this is so powerful that the strongest blast furnace yet ignited by man, at its highest power, is seven times weaker than the sun's heat at its surface. If the heat be electric, how great is the wonder! How is this electricity maintained, if, according to a later theory, the heat is derived from perpetual combustion of matter flying into the sun as coal is projected on a furnace? What millions of tons must every year be consumed!—the heat being dis-

THE WONDERS OF THE MAGNET.

How true it is that familiarity with the strange and marvellous soon reduces it to the level of the uninteresting and commonplace! Only come in contact every day with a phenomenon which at first excited our attention and aroused our wonder, and we soon cease to be astonished; in time the oft-repeated experiment, or oft-observed phenomenon, does not even attract our attention, and no longer causes us to halt in our path to ask Why? or even to satisfy our unquestioning curiosity.

We all know what a magnet is; dozens of the little red horseshoes hang side by side in the window of every scientific shopman. The eye is attracted by their bright colouring, but one sees at once they are only magnets; perhaps we notice the price, and may think sixpence cheap or dear, but there the thought ends. Is it that magnets are not worth thinking about? or is it that there is nothing after all so very curious or mysterious about them—they are well understood, and we have possessed ourselves of their whole history and relations? No! one passes on unattracted, because we have seen hundreds of magnets, and long familiarity with the phenomenon of magnetism has caused us to cease wondering. The writer remembers once a youth, from the depths of the country, coming into his laboratory. A magnet was lying on the table, he took it up, and touched the armature—the bright piece of iron at the end—which moved backwards and forwards as though it were a hinge; and yet, when he was told to use a little force, he could pull the armature completely off. His astonishment was unbounded; again and again he returned to the magnet, and the magic influence under which the armature seemed to come, upon approaching the horse-shoe, had for him a greater charm than anything else which was shown to him. Familiarity had not rendered him incapable of being

drawn to the magnet, while there are some which are repelled; but the action with all, save iron, is so feeble that we may dismiss them from our consideration.

Pursuing our investigations with substances of an iron nature, we shall find that only one of the iron ores which occurs in the earth's crust in any quantity is attracted by the magnet. This is very singular, because a piece of kidney iron ore is so solid and heavy that the inexperienced would at once pronounce it to be iron, and yet it has not the slightest effect on a magnetised needle. The one ore thus influenced is the best of the iron ores; from it is reduced the celebrated Swedish iron. It is the *lodestone*, every molecule of which is composed of three atoms of iron and four atoms of oxygen. Magnetism seems first to have been observed in lodestone which was found near the town of Magnesia, in Asia Minor, and from the name of the town came the name of the property the ore possessed. How the ore became possessed of its property we shall in our next paper learn.

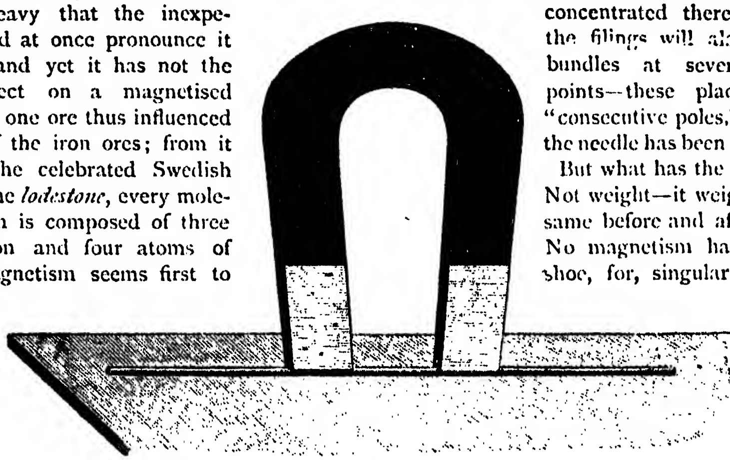


Fig. 1.

The experiments, and who performed them, by which it was discovered that the peculiarity of the lodestone could be imparted to iron, are lost in the mists of distant times. But long before even this the Chinese had a knowledge of magnetism; it is said they have had compass needles for 3,000 years. We have long since given up using the lodestone for producing magnets, and now we can multiply magnets from any single magnet *ad libitum*.

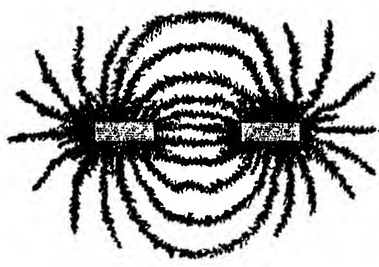


Fig. 2.

The process is simple enough. Take a knitting-needle and pass it over the ends of a magnet, being careful to bring the end of the needle upon one leg of the magnet first, then slowly slide it to the other, and so pass the whole needle over the poles or ends of the magnet, and repeat this eight or ten times. Or the needle may be laid upon a table, the magnet placed upon it as in Fig. 1. The magnet must be placed down upon the centre of the needle, and slid backwards and forwards quite to the end of the needle each time; and the magnet must be removed when at the place where it first touched the needle. If instead of a needle a piece of iron wire were used, it would be found that as soon as the magnet were removed the wire would lose its magnetism, because soft iron is incapable of permanent magnetisation—of steel alone can permanent magnets be made. Now take the needle which you have magnetised, and dip it in some iron-filings. If you have "touched" it properly, you will find that the filings gather in clusters near the ends, seeming to show that the magnetic power is concentrated there; very probably the filings will also be found in bundles at several intermediate points—these places are termed "consecutive poles," and prove that the needle has been badly "touched."

But what has the needle acquired? Not weight—it weighs precisely the same before and after the touching. No magnetism has left the horse-shoe, for, singular to say, it is a stronger magnet, most probably, for having magnetised the needle. Another peculiar fact may be easily ascertained. From the accumulation of filings at the extremities of the needle, it might be supposed that the magnetism had concentrated there; but if now the needle be broken into two or three pieces, and each piece dipped in the filings, the filings cluster at the ends of each piece, just as they did in the whole needle, showing that whatever magnetism is it is not a fluid, like electricity, which can run about and accumulate here or there. And while we have the filings at hand, take a piece of cardboard or stiff paper, and placing it upon the poles of the horse-shoe; sift the filings over it, and by gently tapping the paper they will arrange themselves as in Fig. 2; and if the magnet be moved beneath the paper, the filings will rise and fall as if an unseen wave passed through them; and a little observation will convince you that there are curved lines of magnetic action passing from one pole to the other, and the filings really follow these curves.

The magnetic atmosphere which surrounds the poles has more powers than iron filings can make apparent. Baron von Reichenbach found that there is always amongst fifteen or twenty persons one at least who can feel a very singular sensation when a strong magnet is moved down the back withou

touching the clothes. The feeling resembles a cool or tepid current of air, and in some instances it was accompanied by a pricking and dragging sensation; and not only this, but other persons could see with more or less distinctness flames of light or a luminous halo round the extremities of the magnet.

Suspend the needle you have magnetised, and you will find that it places itself north and south. But it does not point, as is generally supposed, to the north pole of the earth, but if you followed its leading, you would at length arrive at a point upon the shore of Hudson's Bay, many hundred miles from the north pole; and what is utterly inexplicable is the fact that this point to which the needle always turns is not stationary, but it is constantly moving in a circle about the earth's north pole, which it completely circumnavigates once in 600 years!

There are two of these points—another on the eastern coast of Siberia. So, near the south pole there are also two magnetic poles; not opposite the two northern poles, but on the same hemisphere with them!

When philosophers first sought for an explanation why the needle always was attracted to the north, it was suggested that a large quantity of lodestone was to be found in the arctic regions. This supposition was the result of observing that when the one pole of a magnet was brought near to the suspended needle, that it attracted one end and repelled the other. A north pole is found to at-

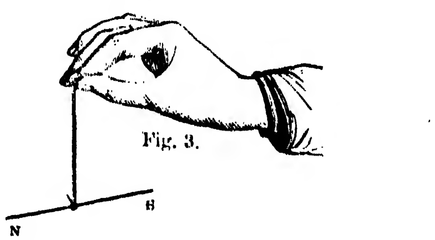


Fig. 3.

tract a south pole (Fig. 3), while it will repel a north pole. So we say, "Like poles repel, unlike poles attract." The Arctic lodestone was supposed to be one pole of a mighty magnet, which was, indeed the axis of the earth, and the other end of which was somewhere in the Antarctic regions, and these two poles attracted all the magnets on the surface of the earth, and made them all point in one direction. But if this were the case all magnetised needles would not only turn towards the north, but be *attracted* thither. Now, if a magnetic needle be balanced on a piece of cork, and placed in a basin of water, it will be found that the needle will turn north and south, but will exhibit no inclination to leave the centre of the basin and approach that side nearest the north; thus plainly proving that whatever force induces the needle to place itself north and south, it has not an *attractive* but *directive* force.

Wonders of Mind.

WONDERFUL MEMORY OF CARDINAL MEZZOFANTI.—Mezzofanti was the son of a carpenter, and was intended to be brought up to the same trade. A priest, however, saved him from a position, out of which he would inevitably have raised himself, and had him educated for the priesthood. He acquired, before the completion of his university career, the Latin, Greek, Hebrew, Arabic, Spanish, French, German, and Swedish languages. At the age of twenty-two, he was made first professor of Arabic, and afterwards of the Oriental languages at the university. In 1841, Guido Görres, the great German scholar, wrote of Mezzofanti, that he was familiar with Greek, Latin, Italian, French, German, Spanish, Portuguese, English, Dutch, Danish, Swedish, Russian, Polish, Bohemian, Servian, Hungarian, Turkish, Irish, Welsh, Wallachian, Albanian, Bulgarian, and Illyrian. He also stated him to be master of Sanscrit, Persian, Koordish, Georgian, Armenian, Hebrew, Arabic, Syriac, Samaritan, the Chaldee, the Sabaic, Chinese, Coptic, Ethiopic, Abyssinian, Amharic, and Angolese languages. Mezzofanti would detect the particular county from which an Englishman came—in fact, he was acquainted with all varieties of dialect, patois, and provincialisms. Cardinal Wiseman asserted that to his certain knowledge Mezzofanti was once taken by a Portuguese for a fellow-countryman, and again was supposed by an Englishman to be a native of England. Before his death, which happened on the 15th of March, 1849, Cardinal Mezzofanti must have been thoroughly acquainted with from seventy to eighty languages.

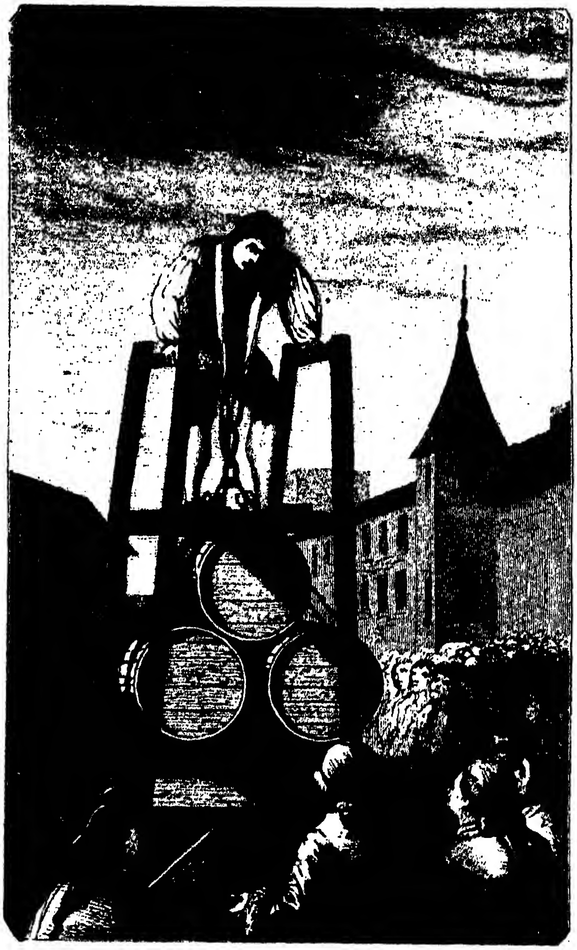
A WONDER OF PRECOCITY.—Christian Heinecker was born at Lubeck on the 6th of February, 1721. When only ten months old he could repeat every word that was said to him; at twelve months he knew the principal events in the Pentateuch by heart; at two years he learned the historical parts of the Old and New Testaments; in his third year he could reply to most questions on universal history and geography, and in the same year he learned to speak Latin and French; in his fourth year he employed himself in the study of religion and the history of the church, and he was able not only to repeat what he had read, but also to reason upon it, and express his own judgment. The King of Denmark wished to see this wonderful child, so he was taken to Copenhagen, there examined before the court, and proclaimed to be a wonder. On his return home he learned to write, but his constitution being weak, he shortly afterwards fell ill. He died on the 27th of June, 1725. There is one account of this child published by M. Martini, at Lübeck, in 1730, and another by M. de Schoneich, who had been his tutor.

FEATS OF MUSCULAR EXERTION.

MANY wonderful stories have been told as to feats of bodily strength performed by individuals both in ancient and modern days. The legend of Milo, the Greek, who felled an ox with his fist, and afterwards carried it on his shoulders, has been made credible by the execution of similar feats in times comparatively recent; and his great strength was perhaps even surpassed by that of Francis of Vivonne, a courtier of Francis I., who is recorded to have caught a charging bull by the horns, and stopped him. More nearly akin, however, to the feat of Milo was that, mentioned by Froissart, of Ernaulton of Spain, in the fourteenth century. It is related of this hero that, one bitterly cold Christmas-day, he observed the hall of the Count de Foix's castle was but indifferently warmed, and looking down into the courtyard, he espied some asses laden with wood which had just arrived for the service of the house. He soon descended into the yard, and placing one of the animals on his back, wood and all, he returned up a flight of steps with this heavy load, and threw both donkey and wood upon the fire.

Of Maurice of Saxony, son of the Elector Augustus II., it is recorded that his strength of finger was so great that he could snap iron horse shoes between his fingers like pieces of glass; and on one occasion, finding himself in want of a corkscrew, he took a long nail, and with his fingers twisted it round into the shape of the implement he required.

In the last century there lived in England a man named Thomas Topham, who was renowned for his muscular power. He could with ease roll up in his fingers the pewter platters which were in fashion at that time, or strike an iron poker upon his arm until he bent it at a right angle. He took a bar of iron, and placing it behind his neck, holding the two ends in his hands, he brought those ends forward until they met in front; then—a feat which required still more dexterity—he brought it straight again in a similar manner. He is said to have lifted with his teeth, and held out for a time, a wooden table six feet long, and with half a hundred-weight attached to one extremity. These performances are recorded by Dr. Desaguliers, a French scientific writer, who made it his business to investigate the subject personally, while collecting materials for one of his works.



TOPHAM'S GREAT FEAT.

Topham's most celebrated feat, however, was that of which we give an illustration on this page. In 1741, being then thirty years of age, he went to Derby, and obtained permission of the authorities to display his prowess in public. A stage was erected for him, and on this stage, among other performances, he raised three casks filled with water, the total weight of the three being 1,836 pounds. The manner in which he accomplished this feat is shown in our engraving, and it will be observed that in doing it he brought the muscles of the neck and shoulders particularly into requisition. The muscular strength of his legs had been affected by an injury he sustained during an incautious experiment. He had undertaken to pull against two horses from the trunk of a tree, but being unscientific in his mode of operation, and placing himself disadvantageously, he was defeated, and his knee-

pan was fractured. It was the opinion of Desaguliers that, had he gone properly to work, Topham might have pulled successfully against four horses instead of two.

The two-horse feat was accomplished in the last century by another powerful individual, a German, named Van Eckeburg. This man sat down on an inclined board, with his feet stretched out against a fixed support, and two strong horses were then unable to remove him from his position. Standing upon a platform, like Topham, he sustained the weight of a large cannon round his waist; and at another time, bending his body in the form of an arch, he allowed a large stone of more than a foot in thickness to be broken upon his abdomen by the blow of a sledge-hammer.

Such are some of the feats which the human body is able to accomplish by muscular exertion.

WONDERFUL BIRTHS.

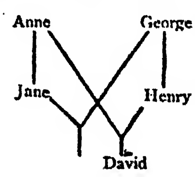
WE propose to give here a notice of some of the most remarkable instances of numerous births which from time to time have been chronicled. It will appear almost incredible that so many as twenty children should have sprung from one mother, but among the cases enumerated here will be found some very much more remarkable in point of number. There is a singular instance of numerous births to be found in the *English Causes Célèbres*, where Colonel James Turner, in his defence, speaking of his wife, says, "She sat down, being somewhat fat and weary, poor heart! I have had twenty-seven children by her, fifteen sons and twelve daughters." Some remarkable instances of this have been chronicled at different times in the *Gentleman's Magazine*. In the year 1736 we find a notice of the birth of the thirty-fifth child by one husband of a woman in Vere Street. In 1743 is recorded the death of Agnes Milbourne, aged 106, who had been the mother of thirty children. In 1738, we are told of a "Mr. Thomas Rogers, a change-broker, who had by his wife twenty-nine children, born and christened." On July 31st, 1781, it is mentioned that a man and woman at Kirton-le-Moor, in Cumberland, together with their thirty children, the youngest of whom was between two and three years old, walked to church to the christening of their thirty-first child. In the *Collectanea Topographica* is noticed the case of Thomas Greenhill, surgeon to the Duke of Norfolk, 1698, who petitioned the Earl Marshal, "that in consideration of your petitioner being the seventh son and thirty-ninth child of one father and mother, your grace would be pleased to signalise it by some particular remark or augmentation in his coat of arms, to transmit to posterity so uncommon a thing." It may be observed that the confirmation of the arms contains no reference to the fact. A still more wonderful instance is given in the same work, of a weaver in Scotland, who had by one woman sixty-two children, of whom four daughters and forty-six sons lived to grow up. This account is given on the authority of several credible witnesses. In each of these cases it will be observed that the children were all born of the same parents. Two other cases are recorded slightly different: one of a man who had eighty-seven children by two wives, of which sixty-nine were by the first, eighteen by the second; another who had seventy-two children by two wives, one of whom was the mother of thirty-two children.

Perhaps still more wonderful are the cases on record of the number of children which have been born at a single birth. It is stated in the *Gentleman's Magazine* for March, 1798, that in the commune of Verchoq, department of Pas-de-Calais, the wife of Pierre François Duisain had six children at a birth, three boys and three girls; they were all born alive, but died soon after. Dinora Salviati, wife of Bartolomeo Frescobaldi, a member of an old Florentine house, gave birth to fifty-two children in all, of whom never less than three were born at one time.

In Aubrey's *Natural History of Wiltshire* we find an account of an inscription at Wishford Magna, to Thomas Bonham and Edith his wife, who died in the years 1473 and 1469 respectively. Mrs. Bonham had two children at one birth the first time, and after an interval of seven years she had as many as seven children at once. There is a tradition, which is recorded in the parish register, that all the seven children were brought together to the font of the church and there baptised.

A WONDER OF RELATIONSHIP.

THE following remarkable genealogical curiosity appeared originally in *Hood's Magazine*, and is a singular piece of reasoning to prove that a man may be his own grandfather. There was a widow [Anne] and her daughter [Jane], and a man [George] and his son [Henry]. The widow married the son, and the daughter married the father. The widow was therefore mother [in law] to her husband's father, and grandmother to her own husband. By this husband she had a son [David], to whom she was also great-grandmother. Now, the son of a great-grandmother must be grandfather or grand-uncle to the person to whom his mother was great-grandmother; but Anne was great-grandmother to him [David], therefore David is his own grandfather. The accompanying diagram will enable the reader to follow this more easily.



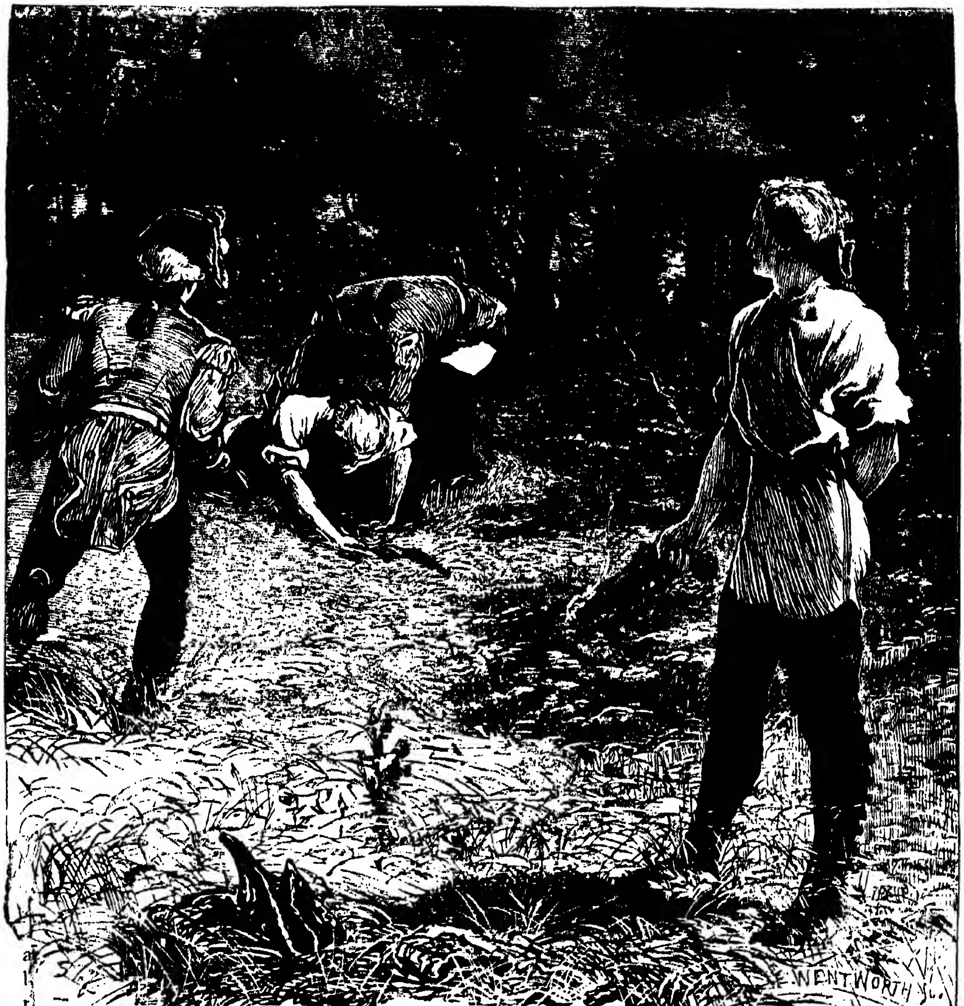
Neither is the Old World altogether destitute of lamp-bearing insects. In England we have the glow-worm, seen so frequently on banks and under moist hedges. In China there is found a species of lantern-fly not unlike the fire-fly of the American savannahs, but differing from it, to a certain extent, both in form and colour.

insects become luminous which are not ordinarily light-bearers, and that these have sometimes been the cause of the very unusual and curious phenomenon known as the Will o'-the-wisp, or *Ignis fatuus.* The *Ignis fatuus*—in plain English, fool-fire—is an earth meteor, resembling a flame, which floats above the ground at the distance of a few feet. It is ob-

THE GREAT LANTERN-FLY.

Luminosity has been ascribed to many other insects at different times, especially to the American and Chinese lantern-flies, neither of which are usually possessed of the property of shining in the dark, at least under ordinary circumstances. It seems probable that their reputed power of doing so must be set down as a mere traveller's tale, told simply for the sake of exciting the universal and insatiable love for the marvellous. It is possible, however, that under some peculiar conditions many

served at night over marshes and burial-grounds, hence it is called the Heath-fire, Corpse-candle, or Will-o' the-wisp, *i.e.*, Will with the torch-light. Derham, in 1729, saw "a decayed hurdle give out a flame, which receded as he approached." In the *Philosophical Transactions* of 1694 there is an account of hay-ricks being burnt by a fire which came out of the sea. Herr Treba, in 1794, saw one which went back 500 paces as he came near, departed, and again became visible at the end of half an hour.



"SHE HAD TO FIGHT A DUEL WITH A RIVAL."—*p.* 10.

THE BRAVERY OF WOMAN.

CHRISTIANA DAVIS.

THE *Gentleman's Magazine* for August, 1739, records the death of one Christiana Davis, on the 7th July of that year, who served with great valour in the Inniskilling Dragoons, &c. To this extraordinary woman we would call attention. She did not serve in the Inniskillings, but in the 2nd Dragoons, now the Scots Greys, and her history is indeed a wonder. She was born in Dublin, in 1667, the year after the great fire of London. When her father, who was a maltster and brewer, was in arms for William III, the Papists blocked up the church door of Leslip, while her mother was at church, with blocks and other lumber. "Fearing my mother would receive some hurt," she adds, in her own account of it, "I seized a spit, and sallied forth to force my way; but being resisted by a sergeant, I ran my spit through the calf of his leg, and removed the things which blocked up the door, and called to my mother, bidding her come away, for the dinner was ready!"

This was a good beginning for a brave life. Not long afterwards her aunt died, leaving her a tavern, to which she removed, marrying one Richard Welsh, who proved a tender husband to her. It would seem that the first overtures were made through

a female friend. One day Welsh was persuaded to take farewell of a schoolfellow, and having been induced to share a bowl of punch on board a vessel laden with recruits, was made intoxicated, and carried over to Holland—a very usual trick in those days. Here he was made to enlist in Lord Orrery's regiment of foot, now the 5th Royals. Then began the wife's trials and her heroism; and truly her life forms a very wonderful story. Determined to find her husband, she left one child with her mother, and one, born after her husband's departure, with her nurse. She cut off her hair, dressed herself in her husband's clothes, and finding Ensign Lawrence beating up for recruits at the "Golden Last," she enlisted under the name of Christopher Welsh. She was soon after at the battle of Landen, where she was wounded above the ancle, and "heard the cannon play, and the small-shot rattle about me," she wrote, "which put me in a sort of panic." Her wound laid her up for two months, and after that she was taken prisoner and much urged to enlist in the French army, in which, at that time, many Irish were serving. She was shortly exchanged, and sent back to duty, and in one of the towns occupied by our troops won the love of a burgher's fair daughter—which, by the way, was not wonderful, as Christiana made a very pretty soldier. What follows, however, was more remarkable. She had, in accordance with the mistaken ideas of honour then prevalent, to fight a duel with a rival, a sergeant in the same regiment, and so wounded him that, his wounds being thought mortal, she was imprisoned. Even there she was troubled by the sweetheart whom she had won; but her wit was equal to the occasion. With many tears she parted from her love, telling her she sacrificed her because "she was only too sensible that her father would not bestow her hand on a poor foot soldier." Proposing, therefore, to work her way upwards by bravery to a commission, she cut herself free of her too fond sweetheart.

Her term being out as a foot soldier, she tried the cavalry, and served with honour in Lord John Hay's Dragoons, now the Scots Greys, being present in 1695 at the siege of Namur. After the peace of Ryswick, Christiana, not having found her husband, returned to Ireland, unknown and unrecognised, so much was she bronzed and altered by exposure. She visited her children, but being too poor to pay the expenses she had incurred, was glad to pass unknown. War again breaking out, she joined her old regiment, was engaged at Nimeguen, at the siege of Venloo, and at the second attack at Schellenberg, where she received a ball in her hip, which was never extracted. Although taken to hospital, her sex escaped detection. Convalescent, but still carrying the ball in her wound, she was, at the glorious battle of Blenheim, set to guard the prisoners, and there by chance she met with her husband, who, having thought her long dead, was consoling himself with the attentions of a Dutch woman. At once Christiana's love forgave all; she made herself known to him, and finding him to be in Lord Orkney's regiment, resolved to serve with him and pass as his brother; then she left him, giving him a piece of gold as a token of her love.

All through the great war, conducted by the greatest captain of that age, or, perhaps, of any other, the Duke of Marlborough, this heroic woman fought. At Ramillies she went through the thickest of the battle unhurt; but unhappily, when the fight was done, a piece of shell from a steeple, exploding, struck the back of her head and fractured her skull. She was trepanned, and suffered immensely for ten weeks; but this did not trouble her so much as the discovery of her sex. The news spread far and near, and Lord John Hay, her colonel, said she should want for nothing. Brigadier Preston made her a present of a new silk dress, her husband was brought to her, and she was set free from the service with a handsome present. Nor was this all; the chaplain of the regiment declared that there should be a new wedding, all the officers being invited to the ceremony, and with much fun and jollity this took place; the bride's stocking was thrown according to old custom, and, on taking leave, all the officers, commencing with the colonel, begged permission, with the solemn politeness of the times, to kiss the lips of the bride.

At a battle near Ath she wounded one soldier in the hand and killed another. At the same time a shot wounded her in the chin, and knocked her down. Her husband ran to pick her up, thinking her dead, but found her only stunned. At Ghent, the Dutch woman before spoken of inveigled her husband into a public-house, on which Christiana fought with her, and cut her nose off with a case knife, close to her face. At the siege of Ghent she followed her husband in the forlorn hope, and, eluding the vigilance of the colonel, who would have stopped her, found him and gave him "a bottle of brandy, which was a great comfort to him." He was killed at the hot battle of Malplaquet, and the fond wife came up just as his body was being stripped by a marauder, whom she beat off. Throwing her husband's body across her mare (she then acted as a sutler), she took it to the rear, buried it, and would have thrown herself into the grave with it had she not been prevented.

This singular woman was married twice afterwards; she was presented with fifty pounds by Queen Anne, and a shilling a day for life, which pension Lord Treasurer Oxford reduced to fivepence; but Mr. Secretary Craggs, the friend of Pope, replaced it at its original sum. She marched with other soldiers—and with streaming eyes and a heavy heart—at the funeral of the great Duke of Marlborough, under whom she had fought so

long and so well; and died loyally at last, full of the same courage and love she had ever shown. Her husband was taken ill; and, though sinking herself under old age and wounds, she insisted on sitting up to nurse him, by which she caught a cold, and then fell into a fever, by which she died, on the 7th of July, 1739. She was buried in the burial-ground of Chelsea Hospital, a detachment firing three volleys over her grave as for a brave comrade and fellow-soldier.

WONDERFUL PERFORMANCES WITH THE MOUTH AND FOOT.—The following is extracted from the "Diary of John Rous" (Camden Society) p. 84:—"Some years since I saw in Holborn, London, near the bridge, an Italian, who with his mouth did lay certain sheets of paper together, one upon another, lengthwise, between the right hand and the left; and then he took a needle and pricked it through the one end, and so then the other, so that the paper lay sure. Then he took a short text pen, and dipped it in a standish or ink-horn of lead, and therewith wrote *Laus Deo semper*, in a very fair text hand (not written with his hand, but with his mouth); then with another pen he flourished daintily about these letters in divers forms. He did, with his mouth, also take up a needle and thread, pricking the needle right down, out of which he pulled the thread, and took another by (fitter) and put it into the needle. Then, therewith he took three stitches in the cloth with a linen wheel (prepared with a turner's device for the foot). He did spin with his mouth. He wrote fair with his left foot. He used a pencil and painted with his mouth. He took a pretty piece, or gun, with his toes, and poured in a paper of powder, pulled out the scouring-stick very nimbly, rammed in the powder, put up the stick, pulled up the cock with his toes; then another short piece, charged (that had a Swedish firelock), being put in his mouth by another man, he held it forth and discharged it, and forthwith with his toes he discharged the other. He gathered up four or five small dice with his foot, and threw them out featly. His hands were both shrimped and lame."

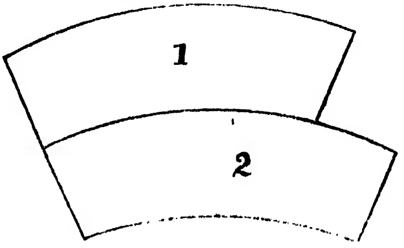
CURIOUS PROVERBS REGARDING JANUARY.—

If the grass grows in Janiveer,
It grows the worse for 't all the year.
A January spring
Is worth naething.
Under water dearth,
Under snow bread.
March in Janiveer,
January in March I fear.
If January calends be summerly gay,
'Twill be winterly weather till the calends of May.
The blackest month in all the year,
Is the month of Janiveer.

WONDERFUL OPTICAL DELUSION.

THE accompanying cut exhibits a somewhat singular optical delusion with which it is possible some of our readers may be unacquainted, though it is frequently made use of by practical builders, in arranging their courses of stone for arches and other curves.

If we take two pieces of cardboard and cut and arrange them as Figs. 1 and 2 are here shown, it will appear to any one who looks at them that Fig. 2 is considerably larger than Fig. 1. If, again, we alter



the relative position of the two pieces, putting 2 in the place of 1, we shall find that their relative size also appears to be altered, and 1 appears larger than 2. If, however, the one be placed so as to cover the other, they will be found exactly the same size. The deception arises thus:—We can see that the right boundary line of 1 would, if extended, cut through 2; hence we fancy 1 is shorter than 2. To measure the length of the curves properly, we should take a point in the centre of each. We shall then find that it is impossible for the same perpendicular to pass through the centres of both, and that the reason 1 does not extend to the right as far as 2, is because it is just that distance out of centre.

Wonders of Natural History.

JOHN HUNTER'S COLLECTION OF ANIMALS.—The variety of birds and beasts to be met with at Earl's Court (the villa of the celebrated John Hunter), is a matter of great entertainment. In the same ground you are surprised to find so many living animals in one herd, and from the most opposite parts of the habitable globe. Buffaloes, rams and sheep from Turkey, and a shawl goat from the East Indies, are among the most remarkable of these that meet the eye; and as they feed together in the greatest harmony, it is natural to inquire what means are taken to make them so familiar and well acquainted with each other. Mr. Hunter told me that when he has a stranger to introduce, he does it by ordering the whole herd to be taken to a strange place—either a field, an empty stable, or any other large outhouse, to which they are all alike unaccustomed. The strangeness of the place so totally engages their attention, as

ULLOA'S CIRCLE.

to prevent them from running at and fighting with the new-comer, as they most probably would do in their own field (in regard to which they entertain very high notions of their exclusive right of property). And here they are confined for some hours, till they appeared reconciled to the stranger, who is then turned out with his new friends, and is generally afterwards well-treated.—*Middleton's "Survey of Middlesex," page* 432.

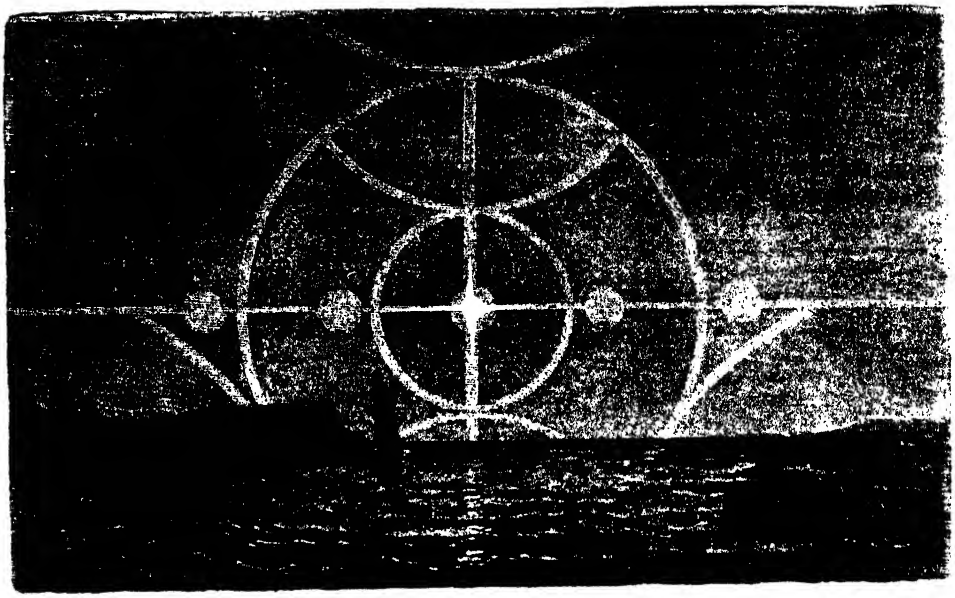
FILIAL PIETY OF CROWS.—In Escameron it is said that the mildness of the crowe is wonderful; for when the old crowes in age be both naked and bare of covering of fethers, then the young crowes hide and cover them with their fethers, and gather meate and feed them. And sometime when they waxe old and feeble, then the young crowes underset them, and reare them up with their wings, and comfort them to use to fly, to bring the members that be diseased into state again.—*From a booken by Barthelmew Glantvile, a Franciscan Frier,* 1360. *Translated by Stephen Batman, Professour in Divi*

Wonders of the Atmosphere.

ULLOA'S CIRCLE.—MOCK SUNS.

THE intensity of the colours of the rainbow has been found to depend in a great measure on the size of the drops of water from which it forms itself. When a rainbow is seen in a fog, the colours of it are always remarkably faint, owing to the minuteness of the drops of water on which the sun's rays fall; so, on the other hand, when we see a rainbow following, as it were, in the wake of a pelting April shower, we are always struck with the vividness and intensity of its hues. The remarkable appearance represented in the illustration is a very peculiar rainbow which was observed by MM. Ulloa and Bouguer during their stay in the Pichincha, and called by them, from the singular faintness of its tints, the *white rainbow*. It is also known as *Ulloa's circle*, from the name of one of the travellers who witnessed it.

M. Ulloa was with his fellow-travellers, one morning at day-break, on the summit of the Pambamarca. The whole of the mountain-top was covered with a dense fog, which gradually dispersed as the sun rose. By degrees the atmosphere became tolerably clear, with the exception of a few light vaporous clouds, so filmy as to be scarcely perceptible. While they were noticing these gradually disappear, one of the travellers, on turning round suddenly to that quarter of the sky which was exactly opposite to the rising sun, perceived an image of himself reflected in the air as distinctly as in a mirror, and standing, apparently, at about the distance of twelve feet from him. The figure appeared to stand in the centre of three concentric rings, which were shaded with different colours, while around the whole was a fourth ring, tinted with one colour alone. The outermost edge of each of the three interior rings was crimson, the next colour was orange, which shaded off through yellow into a pale straw, while the innermost tint was green. The figure, with the surrounding rings, followed every movement of the observer, the rings always keeping the figure in



MOCK SUNS.

their centre. It will be observed in the illustration that the spectral figure is imitating the exact attitude and gesture of the observer. When first seen, they were somewhat oval in shape, but they became gradually more and more circular, and increased in size as the sun rose in the heavens. When they had become nearly perfect circles, the colours gradually grew fainter, the figure more and more shadowy and indistinct, till the whole apparition faded away altogether. It is a singular thing that though each of the travellers saw precisely the same appearance, he saw it only as happening to himself, and could hardly believe that his companions were observing each the reflection of his own figure, while he could see nothing but his own.

Another very singular atmospheric effect is produced by the rays of the sun, and sometimes those of the moon, striking, not upon drops of water, but upon minute crystals of ice. Clouds formed of such crystals are stated by aëronauts to exist in the higher regions of the atmosphere, where they constitute those clouds which are known among meteorologists by the name of cirrus.

The most frequent phenomena of this kind seen in temperate climes are what are called halos, such as we so often see round the moon on a slightly misty night. Sometimes, however, they assume the peculiar form shown in the illustration; but this is of comparatively rare occurrence, and only happens under peculiar conditions of the atmosphere, and when the sun or moon is near the horizon. The circular rings of light are divided by a luminous diameter cutting them horizontally. On this line, a little outside each circle, brilliant patches of light are seen to form, which are called mock suns or mock moons (*parhelia* or *paraselenæ*), according as the sun or moon happens to be the centre of light. Those just outside the inner circle are beautifully coloured with the different hues of the prism, while those altogether outside [illegible] rly colourless. Frequently, also, arcs of [illegible] are seen touching the principal halos, and [illegible], especially at the point of contact, are brilli[illegible] oloured. These are most perfect round th[illegible] ner circle; when they are seen touching the [illegible] side one they are usually faint and indistin[illegible] The illustration shows this interesting phen[illegible] on in the most perfect form in which it is k[illegible] to have appeared.

THE WONDERS OF DIGESTION.

The visitor to that "[illegible] d of Wonders," the South Kensington Muse[illegible] can hardly have failed to notice a remarka[illegible] interesting collection, showing the relative qu[illegible] ities of the various substances that compose t[illegible] human body. The case containing these spec[illegible] nens fo[illegible] s one of the chief attractions of the Food [illegible] artment, and is generally surrounded by num[illegible] s of visitors, old and young, who marvel to [illegible] that their bodies are made up of several [illegible] s of water, a mass of charcoal sufficient to [illegible] k a good dinner, a quantity of hydrogen [illegible] would float a small balloon, a piece of iron la[illegible] e enough to make a pocket-knife, and a lump of phosphorus that would serv[illegible] for half a

dozen boxes of lucifer-matches. In addition to these substances, the visitor will also find various proportions of soda, potash, lime, magnesia, oxygen, chlorine, and nitrogen. Every time that he has made a step, or even turned over a leaf of his catalogue, he has worn out a portion of his body. If he has eaten a hearty breakfast, and is in good health, this wearing out of the body may go on for some time without his perceiving it, owing to there being a superabundance of material to work upon; but as soon as the call for fresh blood is unanswered, the sensation of hunger is experienced, and the desire to supply new material for consumption becomes imperative. If he is pressed for time he takes a glass of wine and a biscuit, or possibly a jelly, and waits until he reaches home for a more substantial meal. As soon as he has swallowed the jelly or other light food, the sensation of hunger disappears, and almost before he leaves the refreshment room he begins to use the fresh material that has already passed into his blood. The effect is, as it were, magical, he can now walk upright and briskly, whereas only a few moments ago he could hardly drag one leg after the other. This marvel has been performed by the aid of those wonderful natural processes, digestion and assimilation.

In repairing the waste that is constantly going on within our bodies we have to consider two processes, each of which is entirely distinct from the other, one of them is *digestion*, the other *assimilation*. Instead of endeavouring to give precise definitions of the exact meaning of these two words, it will be much more easy and pleasant to pass once more into the South Kensington Grill Room, and trace the various steps by which an ordinary luncheon is converted into blood, muscle, and bone. The process of digestion may be said to begin long before we even see our food, for the sheep-farmer has taken good care that the mutton-chop before us shall be juicy and tender, and the cook has seconded his endeavours by using his utmost skill to preserve and increase these good qualities; and this is just precisely what it should do, for we should find mastication extremely difficult, nay, almost impossible, except our mouths were filled with an abundant supply of saliva, which not only assists us in chewing our food into a pulp, but also in tasting and swallowing it. At one time it was supposed that the saliva was a powerful solvent ot the food we take into our mouths, but numerous experiments have proved that in the case, at any rate, of animal substances, its action is merely mechanical. It begins the digestion of vegetable food, however, in rather a singular manner. If we take a piece of stale bread and chew it into a pulp, we shall find that it gradually becomes sweeter the more it is mixed with the saliva. This peculiar action is hardly to be explained without going more deeply into the chemistry of the subject, but it may be mentioned that bread, potatoes, and, indeed, most vegetable foods contain a notable quantity of starch, part of which is transformed into sugar by the action of the saliva. In sight of this fact there will be no difficulty in understanding how an invalid will be able to digest a hard piece of dry bread, whereas, a basin of thin arrowroot will throw him into an agony of indigestion. The drier the bread the greater the quantity of starch converted into sugar by mastication with the saliva. But to go back to our mouthful of chop. Having crushed it into a pulp with our teeth, the natural juices of the meat escape and pass into the stomach, where they find themselves in a large bag, the whole of whose surface is covered with a series of tiny finger-like projections, from every part of which a thin fluid is pouring out. Presently, down comes a mass of masticated chop, potato, and bread, washed down with a draught of water or beer. The fluid secreted by the little finger-like bodies at once begins to act on the chewed food, and is assisted in its work by the muscular coating of the stomach, which, by a series of involuntary contractions, produces a rotary movement of the food, somewhat analogous to that caused by the tongue during the operation of mastication. The fluid acts on it chemically, and it becomes more and more liquid until, at last, it assumes the consistence of a thin pulp, known technically as chyme. The time taken up by this process varies considerably, according to circumstances. The gastric fluid contains a large proportion of acid, and a peculiar animal principle called pepsin. The combined action of the acid and the pepsin, which is a kind of ferment, together with the churning movement, reduces the animal portion of the food to the state of soft pulp with great rapidity, provided that the meat has been tender and juicy in the first place, and properly chewed in the second.

The food having been reduced to chyme, let us now follow it in its further transformations. The pulpy mass that we have already examined passes into that portion of the body known to anatomists as the small intestines. Shortly after it quits the stomach, and while still in the first of the small intestines, the duodenum, the liver pours out upon it a secretion of a peculiar character, known to all the world as the bile. The part played by the bile in the digestion of food, is a somewhat difficult one to describe, seeing that the highest physiological authorities are at variance as to its action. One great use of the bile appears to be in its power of stimulating muscular fibre, by which it keeps the small intestines in a continual state of movement.

We now come to that portion of the powers of digestion when the food is acted upon by the secretion formed by the sweet-bread or pancreas, which is poured into the small intestines just after it has received its modicum of bile. The pancreatic

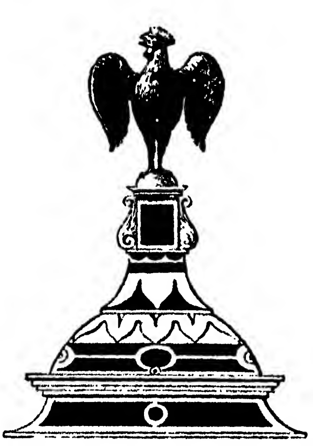
fluid appears greatly to resemble the saliva in its properties. It transforms the starch globules that have passed through the stomach undigested into sugar, and also dissolves the muscular fibres which have hitherto only been masticated. Another very important function of the pancreatic fluid is its power of forming an emulsion with fats and oils that is capable of being absorbed by the system. The pancreas is greatly assisted in its action by the intestinal fluid which is secreted by certain portions of the small intestine itself, which appears to have a solvent action on those portions of the food that have escaped the power of the other fluids; in fact, it may be looked upon as being a universal solvent. The milky fluid now formed, is termed the chyle, and is absorbed into the system by the vessels of the intestinal walls by which they are conveyed into the blood. These vessels are known as the absorbents, and form the connecting links between the digestive and sanguiniferous systems. As the chyle is absorbed it changes its character. First the presence of fibrin begins to manifest itself, then it gradually becomes coloured, white corpuscles, apparently identical with those of blood, being formed in great numbers. The temptation to follow it farther on its course now becomes very strong, but we must remember that it is digestion and not assimilation that we are considering.

We have merely attempted here to describe as simply as possible the ordinary every-day action of our digestive organs, which in itself is sufficiently wonderful; the eccentricities of digestion would alone fill many pages. The ostrich is said to be able to digest iron; but if we consider the wonderful process continually going on in our own bodies, the difficulty of performing such a feat will not appear so remarkable. A piece of iron introduced into the stomach would in time be dissolved by the acid contained in the gastric juice; in fact a case is on record where a conjuror, in performing the trick of swallowing a sword-blade, accidentally allowed it to pass too far down the gullet, so that it was impossible to withdraw it. The unfortunate man was ordered acid drinks in abundance. These gradually dissolved the steel, and would no doubt have effected their purpose had not a foolish medical man ordered the conjuror horse exercise towards the end of his treatment. The portion of the sword-blade remaining undissolved was forced against the coats of the stomach by the motion of the horse, and the result was what might have been naturally expected, a severe internal wound and death.

Wonders of Construction.

THE CLOCK AT STRASBURG.

About the middle of the fourteenth century the canon of Strasburg wished mightily for a clock which should be worthy of the magnificent cathedral wherein he would place it. With this end in view, he invited the most learned astronomers and the most skilful mechanicians to vie with each other in producing a clock which should astonish the world, and be no shame to the mighty cathedral. A man came forward; and in 1352 the clock was finished.

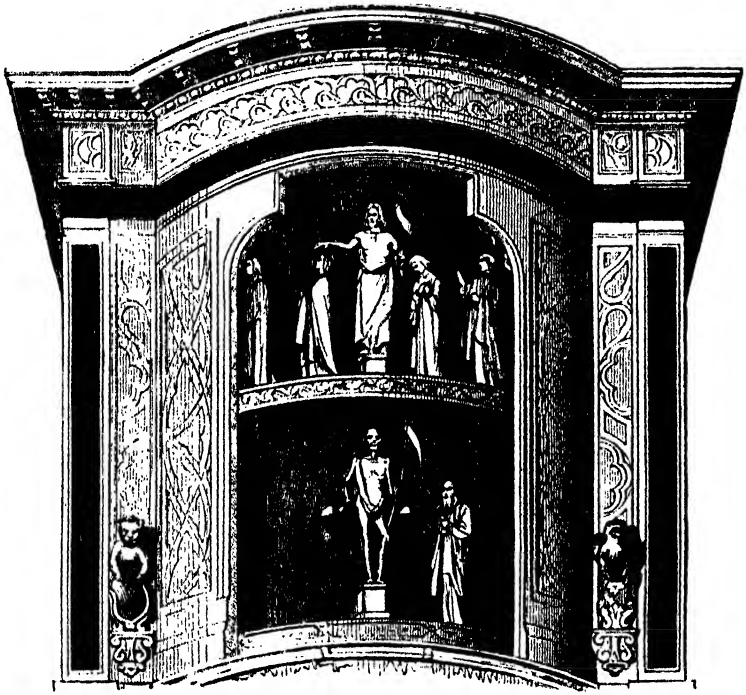


The whole of the Chapter was convoked to behold the first movements of this marvellous machine, which surpassed the most sanguine expectations. A cock perched at the top of a tower flapped his wings a few minutes before the striking of each hour to warn the faithful against the suggestions of that evil spirit, which the chief of the apostles himself had no power to resist. Then Death came and struck upon a sounding bell as many strokes as the hour required, and an equal number of apostles passed in a lowly attitude before Christ, who placed his hands upon them in the attitude of blessing. Finally the chariot of the sun showed by its course round the dial the months and the seasons; and the hands pointed out the different parts of the day, the days of the week, the days of the month, the age of the world, and the year of our Lord.

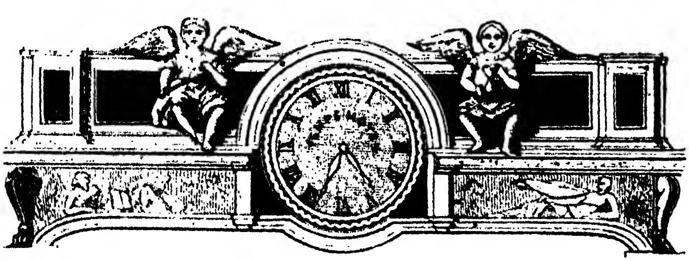
When the canons saw all this their first feelings were of amazement and delight; then they thought within themselves that this man who had been clever enough to make a wonderful clock for them might make many more, and deprive their clock of its celebrity. They immediately determined to deprive the unfortunate man of his sight, and barbarously executed their sentence, not informing their victim until afterwards of the cause for their wicked cruelty. When he learnt it he cried out, "Oh! foolish men, what have you done? The clock is not finished; one piece is still wanting which I alone can supply, and without which it is quite useless." The man was instantly led to his work, when he seized the main wheel which set the whole mechanism in motion, broke it, and thus stopped the movements of the clock for ever. This is the legend of the first Strasburg clock.

But in 1550 a new clock of Strasburg was to be made, and the most noted mathematicians of the time were called upon to preside over its manufacture. The work was interrupted by the death of

some of these. In 1560 it was left solely in the hands of one Conrad Rauchfuss. He joined his friend David Volkenstein, an astronomer of Hamburg, and entrusted the execution of the different parts of the mechanism to the brothers Habrecht, of Schaffhausen, and the decoration to Tobias Stimmer, of Strasburg. This clock was finished on the 28th of June, 1574. Rauchfuss' work was restored in 1669 by Michael Habrecht, and again in 1732 by Jacques Straubhar. It ceased to act in 1789.



The present clock, the most interesting portions of which our engravings represent, was commenced by a clever artist of Strasburg, M. Schineque, on the 24th of June, 1838, and finished on the 2nd of October, 1842.



The central motive-power, which is in itself a clock of wonderful precision, serves to indicate upon a dial-plate placed on the outside of the church the hours and their subdivisions, and the days of the week, with the signs of the planets corresponding to them. These indications are repeated inside upon a double dial, one showing the hours, and another devoted exclusively to the calendar, showing the month, the date, the Dominical letter, the saint's day, &c. Two winged beings are seated on each side of the small dial. At each quarter of an hour the right hand one strikes upon a bell. Immediately the stroke is repeated on all the dials by automata, one representing Childhood, one Youth, another Manhood, and a fourth Old Age. Death, placed upon a pedestal by the side of the Old Man, strikes the hours, and every time he fulfils this grave mission the second of the two winged figures of which we have spoken reverses an hour-glass.

At mid-day, at the striking of the hour, a procession of apostles passes before Christ, who places his hands over them in the attitude of blessing; at the same time the cock perched on a tower flaps his wings and crows thrice. On the ground in front of the clock stands a celestial globe, demonstrating the daily and annual motions of the heavens, stars, and planets with great exactness.

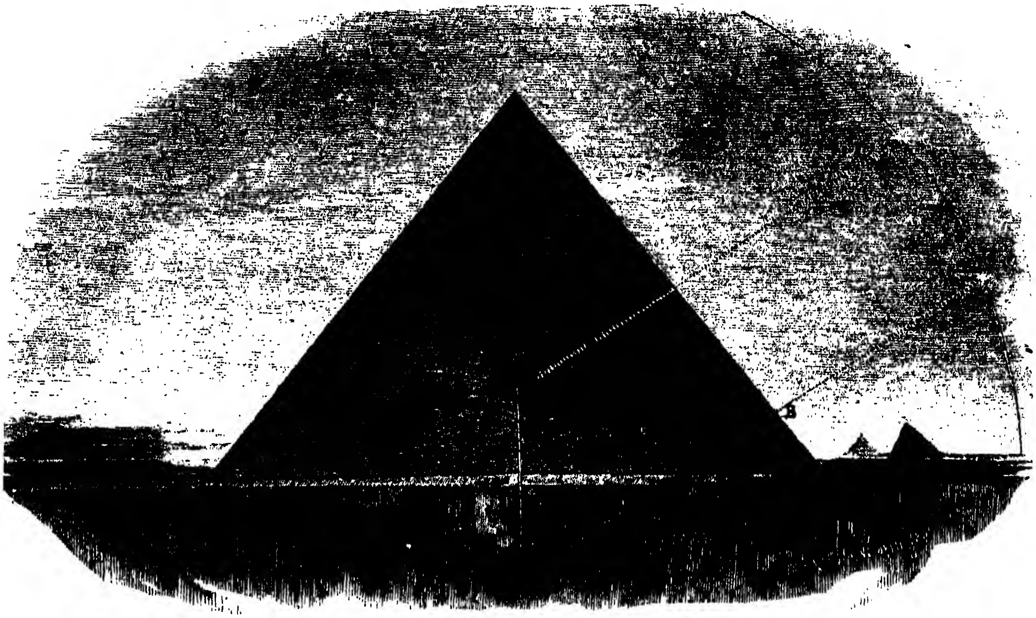


Fig. 1.

of Construction.

THE GREAT PYRAMID.

ON the Nubian or desert side of the river Nile, and within a short distance of the city of Cairo, stands one of the wonders of the world, a vast pile of masonry which has been known for many ages past—indeed, ever since the age of Herodotus—as the "Great Pyramid of Egypt." It is one of a remarkable group of pyramids, situated on the verge of the desert, overlooking, on the one hand, the barren waste of sand, and on the other, the fertile valley of the Nile. It is built on the solid rock, more than 100 feet above the plains of the sacred river, and in its ruined condition appears like a pyramid of steps, formed of immense blocks of stone, by means of which travellers are able to mount to the top. Its base is hidden by the sand which drifts in from the desert, and it is owing to this fact and another circumstance, which will be mentioned directly, that so many different accounts have been given of its height and dimensions during the last three thousand years.

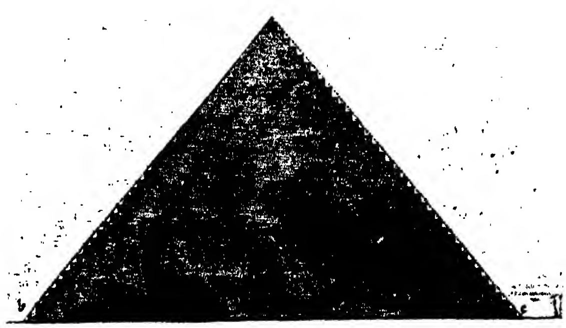


Fig. 2.

Less than a thousand years ago, the rude limestone blocks which form the steps of the Great Pyramid were concealed from view by a casing of polished marble, which must have given an appearance of dazzling brightness to the vast sides of the mysterious pile. Herodotus, who saw the pyramid in its glory, explains that it was built in steps, every step, as it were, forming the scaffold for the next, as seen in Fig. 2, until the builders reached the top. Then the finishing process commenced

the top downwards, by fitting in angular s of marble, and polishing the surface to one perfect level, as represented by the dotted line *a b*. Once finished, ascent would be impossible, unless, for any purpose a narrow space was left uncased, like a ladder, in one of the sides. But that this was done is hardly probable.

So the Great Pyramid stood, "foursquare to every wind that blew," in the pure atmosphere of Egypt, a sight to astonish every beholder, until the caliphs of Egypt began to despoil it of its marble casing for the construction of their mosques and palaces. This extremely senseless work of destruction began about A.D. 1000; but this, unfortunately, was not the only outrage it was fated to undergo. M. Jomard, of the French expedition, remarks that European tourists always seemed to feel an inveterate longing, when they stood on the top of the Great Pyramid, to detach some of the stones, and send them thundering down the sides. In this way the height of the Pyramid has been lessened, and the area of the top enlarged. As a consequence of this, and of the elevation of the ground at the base by the accumulation of drifting sand, the various measurements of the Pyramid have differed very considerably from each other. Still there was always a possibility of ascertaining the dimensions by a mathematical calculation founded on the base line and the angle of inclination of the sides; and this has been done in recent times. The length of the line *b c* (Fig. 2) is now known to be about 764 English feet, and two of the marble casing-stones having been discovered, the angle at which the sides incline has been computed at 51° 51′. The vertical height of the Pyramid, resulting from these data, must have been 486 English feet, or nearly 100 feet higher than St. Paul's Cathedral. Its square base, covering, nearly thirteen acres, may be roughly estimated as equal to the area of Lincoln's Inn Fields. The area of one of its triangular faces is about five acres. The courses of stones vary from two feet two inches to four feet ten inches in height, and many of them measure thirty feet in length. The total quantity of masonry has been estimated at more than 89,000,000 cubic feet. "Suppose," says Mr. Sopwith, "a block of solid masonry, the length, breadth, and height of a moderately-sized sitting-room—say, for example, twenty feet by fifteen, and ten feet high—of such blocks more than 28,330 would be required to make the Pyramid, and if placed lengthwise they would extend over more than 107 miles." Pliny states, in agreement with Herodotus, that the Great Pyramid was twenty years in building, and that 366,000 men were employed in its construction. This, however, is but traditional.

A more important question is that of the use for which it was designed; this problem has exercised the ingenuity of men in all ages, from the time of the ancient Greeks to the present hour, when th work of Professor Piazzi Smyth—doubtful and eve fantastical though some of his conclusions may —has thrown so much light on the question. olden times some were of opinion that the external surfaces were meant to be covered with hieroglyphics recording the history of Egypt; but this ingenious supposition is open to a hundred objections. Others thought it was one of the vast granaries built by the Israelites, but this notion, hardly worth mentioning, has been utterly discredited by what we know of the interior structure, which is nearly solid. It was a more general belief that some astronomical purpose was intended; and there is an Arabian tradition that a certain king named Saurid put in it divers celestial spheres and stars, and the mysterious records connected with them. This theory was superseded by the conviction that the Pyramid was nothing more than the tomb of one of the great kings of Egypt. Finally, Professor Smyth has devoted himself to the solution of the problem, and given to the world one of the most remarkable books of modern times —"Our Inheritance in the Great Pyramid"—published about four years ago.

Before we can give the reader an idea of Professor Smyth's remarkable conclusions, it should be stated that an entrance into the Great Pyramid was known even before the Christian era; and it led into a chamber cut in the solid rock, exactly under the apex of the pile. The entrance (B, Fig. 1) and the chamber (A) to which it conducted were re-discovered in 1820, and there were letters found upon the roof which prove that it had been entered by the Romans. The passage was not built up, but only closed by a sliding block of stone worked by simple machinery; and Professor Smyth has no doubt that it served as "a safety-valve to the Pyramid curiosity of early times, which was thus admitted on rare occasions, and under very imposing circumstances of form and state, to see the interior of the greatest of all the pyramids; and then they saw and made acquaintance with—what? The descending entrance and the subterranean chamber, but nothing else."

In the age of the Caliph Al Mamoun the secret of the interior was partially disclosed, though only to be lost again for ages, under circumstances which make a tale of almost romantic interest. The caliph discovered an ascending passage (D) leading into a chamber (C) containing a polished granite coffin without a lid. It had probably, at one time, held the body of an Egyptian king. Arabian poets drew on their imaginations for a more glorious result of their master's enterprise, and sang of "a dead man with a breastplate of gold, an emerald vase a foot in diameter, and a carbuncle which shone with a light like the light of day, and a sword of inestimable value." Subsequent caliphs

showed their practical appreciation of all this romancing, by commencing the work of destruction to which we have already alluded, and eight centuries rolled by before the attention of the learned was once more called to Egypt and its archæological treasures by the expedition under Buonaparte in 1798.

If the mystery of the Pyramid is solved, its solution confirms one of the most ancient traditions concerning it. According to Professor Piazzi Smyth, it is a stupendous monument of the wisdom of antiquity, and its construction shows an exact knowledge of astronomical science, in some particulars not to be surpassed by the science of the nineteenth century. For example, the passage leading from the chamber (A B, Fig. 1) served as a tube which enabled observations to be made of the then Pole Star at its lower culmination, about the year 2500 B.C.; and a parallel passage (*c*) leading from the chamber C, is supposed to have existed, commanding the star in its upper culmination.

It should be stated that there are in Egypt an immense number of pyramids about which there is little or no mystery at all, as they were obviously designed for sepulchral purposes. They are mostly built of brick.

THE LIVING SKELETON.

IN the year 1825, there was exhibited in Pall Mall, one of the most singular freaks of nature the world has ever seen. This was Claude Ambroise Seurat, commonly known as the living skeleton. He was born at Troyes, in France, in the year 1797, of respectable but poor parents, neither of whom were in any way deformed, or remarkable in their appearance. At his birth, Claude Seurat was as other babies are, plump and fleshy, but in proportion as he grew, his flesh gradually wasted away, until by the time he had attained his full stature, he was little more than a skeleton clothed only with skin, and a few imperfectly developed muscles. The texture of the skin was of a dry parchment-like appearance, though it was, nevertheless, singularly sensitive, and on being touched with the finger, especially on the left side of the body, would contract and roughen with an involuntary chill. The ribs were capable not only of being distinguished, but of being clearly separated, and counted one by one, and even handled like so many pieces of cane.

A writer in the *Times* described the trunk as "having the appearance, more than anything else, of a large bellows—a mere bag of hoops covered with leather, through which the pulsation of the heart was distinctly visible." Sir Astley Cooper, who examined him, found that his heart was as much as its own length out of its usual position, while the action of the lungs appeared to proceed from the lower part of the body. He stood about five feet seven inches high. His countenance is described as by no means displeasing, though somewhat pensive in its expression, his complexion was swarthy, and on his cheeks there was sufficient flesh to prevent him from looking remarkable, when dressed in padded clothes. On the day before his first public exhibition, he walked through the streets with the gentleman who had brought him from France, without in any way exciting attention. His mental powers were at least respectable, better far than those of many a man better formed in body.

The great wonder of Seurat's case appears to lie not so much in his extreme emaciation, as in the fact that such a degree of decay should be compatible with life, and even the enjoyment of life in a moderate degree. He always ate and drank with an appetite, though sparingly; those dishes which afford most nourishment appearing to satisfy him most quickly; and his digestion and general health were good.

Many efforts were made to have him presented to the French king, but these his father always evaded, considering, and probably with good reason, that his son might be consigned to some wretched asylum, dependent only on a miserable pension. To use his own words, he was "wandering about France making but little by exhibiting himself," when he met the gentleman who brought him over to England, and of whose kindness he always spoke in the very highest terms.

WONDERFUL NUMBERS.

SOME very curious properties in numbers have been noticed, which are well enough known to arithmeticians and mathematicians as the necessary result of certain laws, but which at first appear utterly mysterious. The best known of these is the singular property of the number nine, when multiplied by any of the digits, to reproduce itself in the product. Twice 9, for example, is 18, and these two figures, 8 and 1, make 9. If this happened to one or two multiples only it would be less marvellous, but it happens in all, with one equally remarkable exception, thus:—

$9 \times 2 = 18$ and $8 + 1 = 9$
$9 \times 3 = 27$,, $7 + 2 = 9$
$9 \times 4 = 36$,, $6 + 3 = 9$
$9 \times 5 = 45$,, $5 + 4 = 9$
$9 \times 6 = 54$,, $4 + 5 = 9$
$9 \times 7 = 63$,, $3 + 6 = 9$
$9 \times 8 = 72$,, $2 + 7 = 9$
$9 \times 10 = 90$,, $0 + 9 = 9$

And here we come to the exception, 9×11 equals 99, and the product of these figures is 18, but then $8 + 1$ equals 9, so thus the law holds, but a step is

interposed, and that step consists of two nines instead of one. To proceed:—

$9 \times 12 = 108$ and $8 + 0 + 1 = 9$
$9 \times 13 = 117$ „ $7 + 1 + 1 = 9$
$9 \times 14 = 126$ „ $6 + 2 + 1 = 9$
$9 \times 15 = 135$ „ $5 + 3 + 1 = 9$
$9 \times 16 = 144$ „ $4 + 4 + 1 = 9$
$9 \times 17 = 153$ „ $3 + 5 + 1 = 9$
$9 \times 18 = 162$ „ $2 + 6 + 1 = 9$
$9 \times 19 = 171$ „ $1 + 7 + 1 = 9$
$9 \times 20 = 180$ „ $0 + 8 + 1 = 9$

There is in, fact, no limit to this, and another property of the same digit is equally curious. Take any number of two figures and change the order of the digits. Then subtract the one from the other, and the remainder will always be 9. Let the number for example be 89; transpose the digits and it becomes 98; then subtract 89 from 98 and you have 9 left. In high numbers it will be some multiple of 9. Thus, 365 transposed becomes 563, and the lesser taken from the greater leaves 198, which is 9 times 22; or if we add the digits together $8 + 9 + 1$, the sum is 18 and $8 + 1$ equals 9. Any one who choses to exercise himself in experiments of this kind, will hardly fail to hit upon some surprising results.

Another number which falls under some mysterious law of series is 37. If multiplied by 3, or any multiple of 3 up to 27, the product which results is expressed by three similar digits. Thus:—

37 3 = 111
37 6 = 222
37 333
37 444
37 15 555
37 18 666
37 21 777
37 24 = 888
37 × 27

It will be observed that the products also succeed each other in the order of the digits read downwards, 1, 2, 3, 4, 5, 6, 7, 8, 9; and these again being multiplied by three (their number of places), reproduce the multiplicand of 37 from which they resulted. Thus:—

$1 \times 3 = 3$
$2 \times 3 = 6$
$3 \times 3 = 9$
and so on.

Another, and quite distinct class of coincidences is represented by the following table of the periods in which five successive presidents of America were *born* and *went out of office*.

John Adams,	born	1735, retired	1801
Thomas Jefferson	„	1743	1809
James Madison	„	1751	
James Monroe	„	1759	1825
J. Quincy Adams	„	1767	1829

Each of these distinguished men was born eight years after his predecessor, and each went out of office eight years after his predecessor. All but John Quincy Adams were sixty-six years of age when they retired, and three out of the five died alike on the Anniversary of Independence.

WONDERFUL NATURAL CONSTRUCTION.

In the British Museum there is to be seen a fine stuffed specimen of the little nocturnal, grub-eating, climbing quadruped of the Island of Madagascar, called "Aye-aye," most difficult to be obtained there, as the accomplished missionary Ellis tells us in his "Three Visits to Madagascar." The curious name it bears is said to be owing to the cry of astonishment which the natives uttered on beholding for the first time so strange a little creature.

What a strange physiognomy is given to the skull of the little rarity by the enormous, curved, chisel-shaped pair of teeth at the fore part of the upper and under jaws! What can be the meaning of that long, shrivelled middle finger on each of the hands? It looks like a bent probe, only there is a hook at the end. In short, the singularities offered by both skin and skeleton excite the strongest wish to learn more about the little Aye-aye of Madagascar. Dr. Sandwith, of Kars celebrity, was made in 1858 Colonial Secretary at the Island of Mauritius. In the following year the energetic doctor was able to write that he had got from Madagascar the coveted Aye-aye, and desired to know whether it should be transmitted to the British Museum dead or alive? To this the superintendent replied, knowing that he was addressing a medical man who had been familiar with anatomical procedures, "It might be more advantageous to science if the animal were killed by chloroform, and properly preserved." In that state the specimen reached the Museum, where its stuffed skin, its skeleton, its brain, and some other parts in spirits, are evidence of the use made of the opportunity.

But why, some reader may be disposed to ask, should not the Aye-aye have been forwarded to England alive in a cage instead of a cask? The main cause of the failure of every opportunity of supplying Europe with an Aye-aye, was due to the attempt to send home the animal alive. Cuvier, we may be sure, was as anxious to get a specimen as Owen. Twice or thrice his appeals to his countrymen in, or trading with, Madagascar, led to their getting possession of the coveted animal. In each case, before the opportunity of shipping it off arrived, the box, no matter how thick or hard the wood, was empty, and a large round hole showed how successfully the captive had applied its strong, chisel-shaped incisors to effect its escape. The very same misfortune befel Dr. Sandwith. "I am gradually," he writes, "lining his cage with tin, as I observe he attacks the wood-work every night." But not long after the dispatch of the letter in which this precaution is mentioned, the Aye-aye had gnawed its way out. Most fortunately and unexpectedly, the little animal was re-captured in a sugar-plantation, some distance from Port Louis.

THE AYE-AYE.

This quadruped is stated to sleep during the heat and glare of the tropical day, and to move about chiefly at night. The wide openings of the eyelids, and the whole construction of the eye, are arrangements for admitting to the retina, and absorbing, the utmost amount of the light which may pervade the forest at sunset, dawn, or moonlight. Thus the Aye-aye is able to guide itself among the branches in quest of its hidden food. To detect this, however, another sense had need to be developed in great perfection. The large ears are directed to catch and concentrate, and the large acoustic nerve, and its ministering "flocculus," seemed designed to appreciate any feeble vibration that might reach the tympanum from the recess in the hard timber through which the wood-boring insect on which it feeds may be tunnelling its way by repeated scoopings and scrapings of its hard little jaws. How safe from bills of birds or jaws of beasts might seem such a grub in its oak or ebony-cased burrow!

Here, however, is a remarkable animal in which the front teeth, by their number, size, shape, implantation, and provision for perpetual renovation of substance, are especially fitted to enable their possessor to gnaw down, with gouge-like scoops, to the very spot where the ear indicates the grub to be at work. The instincts of the insect, however, warn it to withdraw from the part of the burrow that may be thus exposed. Had the Aye-aye possessed no other instrument—were no other part of its frame specially modified to meet this exigency—it must have proceeded to apply the incisive scoops in order to lay bare the whole of the larval tunnel, to the extent, at least, which would leave no further room for the retracted grub's further retreat. Such labour, however, would have been too much for the reproductive power of even its strongly-built, wide-based, deep-planted, pulp-retaining incisors; in most instances, we may well conceive such labour of complete exposure of the burrow to be disproportionate to the morsel so obtained. Accordingly another part of the frame of the Aye-aye is modified in a singular and, as it seems, anomalous way, to meet this exigency. We may suppose that the insect retracts its head so far from the opening gnawed into its burrow as to be out of reach of the lips, teeth, or tongue of the Aye-aye. One finger, however, on each hand of that animal has been ordained to grow in length, but not in thickness, with the other digits. It remains slender as a probe, and is provided at the end with a small pad and a hook-

like claw. By the doubtless rapid insertion and application of this finger, the grub is felt, seized, and drawn out. But for this delicate manœuvre the Aye-aye needs a free command of its upper or fore-limbs; and to give it that power, one of the digits of the hind foot is so modified and directed that it can be applied thumbwise to the other toes, and the foot is made almost like a hand. Hereby the body is steadied by the firm grasp of these hinder hands during all the operations of the head, jaws, teeth, and fore-paws, required for the discovery and capture of the common and favourite food of this nocturnal animal. Thus we have not only obvious, direct, and perfect adaptations of particular mechanical instruments to particular functions—of feet to grasp, of teeth to erode, of a digit to feel and to extract—but we discern a correlation of these several modifications with each other, and with modifications of the nervous system and sense-organs—of eyes to catch the least glimmer of light, and of ears to detect the feeblest grating of sound—the whole determining a compound mechanism to the perfect performance of a particular kind of work.

WONDERFUL FROSTS.

IT may not be out of place to record a few of the most remarkable instances of severe frost which are chronicled as having occurred in this country. We are informed by a paper on this subject, which appeared in the *Express* of January the 11th, 1861, that the Thames was frozen over for fourteen weeks in the year 1063, and below bridge to Gravesend, from November the 24th to February the 10th, in 1434. In 1515, carriages passed over from Lambeth to Westminster. In 1607, fires were lighted on the river, and all sorts of diversions were carried on. In 1684, the frost was so severe that nearly all the birds perished; the Thames was covered with ice eleven inches thick; at a fair held upon it, printing-presses were erected which struck off verses and inscriptions commemorative of the event, several of which memorials are still extant. A private letter of the date of February the 9th of that year, mentions the appearance of a great deal of ice in the Channel, adding, that it was reported that the ice between Dover and Calais was within about a league of joining. In 1715-16, a fair was again held upon the Thames, and oxen were roasted. This frost lasted from November the 24th to February the 9th. After this, the next severe frost was that which set in on December the 26th, 1740. The cold was intense, many who had lived for years at Hudson's Bay declaring that they had never felt it colder in those parts. The Thames floated with rocks and shoals of ice, and when fixed they represented a snowy field rising everywhere in hillocks and huge rocks of ice and snow. Booths, stalls, and printing-presses were erected, and a Frost Fair held on it. Several people perished with cold in the streets and fields in and about the city. All navigation being obstructed, coals rose to £3 10s. per chaldron; and the damage among the shipping between the Medway and London Bridge was computed at £100,000. Flocks of ducks, widgeon, and coots were found on the ice on the Kent and Essex shores, perished with cold or starved to death. Vast quantities of fish, especially eels, were found frozen to death on the banks of the Severn, near Thornbury, in Gloucestershire; and flocks of crows resorted there to feed on them. In Suffolk, wild geese and other birds devoured the winter corn close to the earth for the space of many acres. In Hertfordshire numbers of oaks were riven by the frost, which made clefts in the solid timber as deep as a case-knife could be thrust. The rivers Severn, Lyne, the Avon by Bristol, the rivers Forth, Tay, &c., in Scotland, and the Liffey by Dublin, were all frozen up like the Thames; and by all advices from Holland, France, Germany, &c., the cold was extreme. In Poland and Lithuania the inhabitants, besides what they suffered by the frost, were very much incommoded by the bears and wolves, which ranged about devouring men and cattle. In Podolia, whence the Russians in their march had carried off all the forage and most of the provisions (though they left money for it), the inhabitants were perishing both with hunger and cold. The streets of London were so clogged with snow and ice that hackney-coaches went with three or four horses, and coal carts were drawn from the wharfs with eight horses: and Fleet Street was so long neglected and so dangerous, that scores of men were at work on Sunday, the 27th, to clear the way.

In the "History of the City of Glasgow," by James Denholm (Glasgow, 1804), we are told that the end of 1784 and the beginning of 1785 were remarkable for a long-continued frost; it lasted four months—till the 14th of March, when the ice upon the Clyde broke. Upon December the 21st the cold was so intense that the thermometer showed twenty degrees below the freezing point. In London, the continuance of the frost was still longer, being no less than five months and twenty-four days—in all, one hundred and seventy-six days—the longest continuance of frost on record.

From November, 1788, to January, 1789, the Thames was frozen over opposite the Custom House sufficiently firm for passing over. The year 1814 is, we believe, the last occasion on record on which this occurred.

CAPTURE OF A WHALE IN THE THAMES.

A CURIOUS old tract in the British Museum, bearing the date of 1658, gives an account of a wonderful capture of a whale in the Thames, not

far from Greenwich, in the month of June of that year. The sailors in the river were, of course, anxious to secure the huge monster who had been so rash as to invade our shores; but they found no slight difficulty in despatching it. All sorts of swords, axes, and hatchets, and even guns were brought into the service; but nothing effectual could be done till some one's ingenuity suggested striking a couple of anchors into the creature's body. By these it was held fast, and very soon bled to death. Hundreds of people flocked to see the monstrous stranger, and among others went Evelyn, author of the "Diary," who has left us a curious account of it. It was of no contemptible size, being fifty-eight feet long, twelve feet high, fourteen feet broad, and measured two feet between the eyes.

A WONDER OF INTRIGUE.

In the year 1771 an extraordinary case was tried in the Court of King's Bench, Guildhall, by Lord Chief Justice Mansfield. The question was, whether a distinguished person, known as the Chevalier d'Eon, at one time ambassador from the Court of France to that of England, was a man or a woman. The case was brought into court in consequence of certain heavy bets that had been made as to the point at issue. A great deal of evidence was given. Lord Mansfield, one of our most acute judges, summed up carefully, and the jury, without hesitation, found for the plaintiff, thereby solemnly recording their belief that D'Eon was a woman. Nevertheless, in 1810, when the chevalier died, at the advanced age of eighty-two, it was proved that he was a man. At any time between those two dates, and for some years previous to the earlier one, public opinion was divided on this strange problem, though latterly the verdict of the jury had been received as a sufficient settlement of the question. How the mystification originated, and why it was carried on, will appear from the following account of D'Eon's career.

Charles Geneviève Louis Auguste André Timothée d'Eon de Beaumont was born in 1728, at Tonnerre, in the Province of Burgundy. The family is enrolled in the genealogical books of France as an ancient and illustrious one. His father and grandfather were both intendants of their municipality, and his mother, Françoise de Charenton, was the daughter of M. de Charenton, commissary of the French armies in France and Italy. It may be said, under these circumstances, that Charles d'Eon was born to good fortune. He was educated in conformity with his prospects, and took his degrees as doctor of civil and of canon law, became advocate of the Parliament of Paris, and was appointed Censor of Belles Lettres and History. He was besides an extraordinary adept in riding and fencing.

While engaged in all these employments and studies, and also making a name in literature by his occasional publications, D'Eon became known to the Prince of Conti, and was introduced by him to the Court of Louis XV. At that time, 1755, the king was anxious to reconcile the Court of St. Petersburg to his policy, and secure its alliance in the war against Prussia. In order to negotiate with success, secrecy and easy access to the sovereign of Russia were essential. How it was brought about, and what strange circumstances had preceded the daring attempt we know not, but D'Eon, disguised as a woman, went to St. Petersburg as reader of the French language, and secretary to the wife of the great Chancellor Woronzoff, who had married a Russian princess nearly related to the Empress Elizabeth. The intrigue succeeded so well that he was sent again the following year in his proper character as a man, in conjunction with the Chevalier Douglas, and with an avowed diplomatic mission. As a consequence of these negotiations, Elizabeth joined the armies of France and Austria with 80,000 men, who were to have taken the field in aid of the King of Prussia. D'Eon, returning to Paris, was dispatched to Vienna to communicate the plan of operations agreed upon by Russia, and the famous battle of Prague was fought while he was in that capital. He hastened with the news of victory to Paris, and the king rewarded him with a commission as lieutenant of dragoons.

In 1759, after a third visit to the Court of Russia, D'Eon joined his regiment in Germany, with the rank of captain, and with an appointment as aide-de-camp to the Count and Marshal de Broglio. In the engagement at Ultrop he was twice wounded; and at the siege of Ostervitch, with only fourscore dragoons and forty hussars, he completely routed a Prussian battalion, and took the commanding officer prisoner. In 1762 he was on the point of going as ambassador to Russia, when the death of Peter III. changed the relations between the two courts. So great, however, was the king's confidence in D'Eon, that he was sent to London, in September of the same year, as secretary of embassy to the Duke de Nivernois. The circumstances which followed proved the wisdom of this appointment; for it is doubtful if the Peace of 1763 would have been ratified if D'Eon, by his address, had not rescued the minister from the very serious dilemma in which his dishonourable conduct had placed him. On the duke's return to Paris, he showed his sense of the value of D'Eon's services, by procuring for him the appointment of Minister Plenipotentiary to the Court of Great Britain. Somewhat later, the king also granted him a handsome pension.

About the time of the first election which took place after the Peace of 1763, doubts began to be circulated about the sex of the Chevalier d'Eon. From that period to 1771, when the trial took place to which we have alluded, there was much speculation afloat on this subject, both in the press and in society. One day the Chevalier d'Eon was found mysteriously wanting, and it had been given out by himself that a conspiracy existed against him. His name was continually before the public in some enigmatical shape. The rage for betting on the question, whether he was a man or a woman, took possession of the public; and after six years of ridiculous anxiety on this point, Mr. Hayes, a surgeon in Leicester Fields, brought an action against one Jacques, a broker and underwriter, to recover the sum of £700. The plaintiff alleged that Mr. Jacques had received premiums of fifteen guineas per cent., for every one of which he stood engaged to return one hundred guineas whenever it should be proved that the Chevalier d'Eon was a woman. This proof, Mr. Hayes contended, he now possessed; and, after a good deal of hard swearing, he gained his cause. Other sums, to an immense amount, depended on this suit; and we now know that the witnesses who decided it were perjured.

It cannot fail to strike the reader that D'Eon himself had it in his power to settle the dispute at once; but he remained in the background, allowed the secondary evidence full power, and otherwise acted in an equivocal manner. All this is easy to understand on the hypothesis that he was interested in the bets and policies; but this he absolutely denied in writing, and owing to his denial, the winners of the cause never touched a farthing of the money. The reason of this would require a legal explanation which it is not necessary to enter upon.

From the period of this extraordinary trial to the end of his life, D'Eon was placed in a more equivocal position than ever by the action of the French Court. Affecting to believe that he was really a woman, that Government continued his pension on condition of his wearing the apparel becoming to his sex. The reader may imagine the daily awkwardness of this to a man of the highest accomplishments, moving in the best society. The curious engraving, of which we here give a copy, was meant for a caricature of his double character by the wits of Paris; and all sorts of anecdotes were circulated in illustration of his equivocal character and position. Some may think he might have manfully declared the truth, and released himself from his ignoble bonds. But it was commonly reported in Paris that he had only the choice of obeying, or of ending his days in the Bastile. It is very possible that he had compromised the honour of many noble families in his assumed character, and it was only so long as he was willing to pass for a woman, and so put an end to the scandals connected with his name, that he could be allowed to remain at large. Those were the days, be it remembered, of the tyrannical *lettres-de-cachet*, and many, with less reason, had been consigned to the dungeons of the Bastile.

Until the French Revolution broke out, the Chevalier d'Eon lived in obscurity for several years with Lord Ferrers at Staunton Harold, and allowed the world to believe that he was a woman. Sometimes he would exhibit his skill in fencing, and on one memorable occasion he engaged in a match with the celebrated Chevalier de Saint George, before the Prince of Wales, at Carlton House. The destruction of monarchy in France and other occurrences had deprived him of his sole means of support in old age, and the English papers of 1791 and subsequent years contain advertisements of his exhibitions of fencing. These entertainments seem to have been very attractive, as the chevalier retained the costume to which he had so long been accustomed. Sometimes, indeed, he came out in character, as at Ranelagh and the King's Theatre, when he appeared upon the stage dressed in armour, with a casque and feather, representing Minerva, or the Maid of Orleans. In spite of his exertions in this way, old age and distress overtook him, and he died, after having been bedridden for two years, in 1810. Then the discovery was made which reversed the verdict of 1771, and the public interest of forty years before was renewed. Without a doubt the career of the Chevalier d'Eon is one of the strangest on record. That a man learned, elegant, and polite; a soldier, a statesman, an ambassador; in fine, a man of superior accomplishments, should have passed one half of his life in the character proper to him, and lingered away the other half in that of an obscure and neglected old woman, is a case, perhaps, without a parallel.

WONDERS OF VEGETATION.

SOME striking resemblance in vegetation to the human form is by no means an uncommon phenomenon, and many are the legends to which wonders of this kind have given rise. There is the story of the mandrake, for example, which is said to shriek when it is pulled out of the ground. Avicenna relates that a Jew at Metz had a mandrake preserved in spirits which had a human head, and the legs and body of a cock. This may have been, for a book might be filled with similar marvels; but what shall we say when the same authority informs us that the mandragore of Metz lived five weeks, and was fed on grains of lavender and earthworms?

The accompanying sketch represents three of the most remarkable vegetable oddities which have been noticed, and it will be seen from our account of them that there is no reason to believe that the representations, which are copied from old prints, are exaggerated.

The turnip with a human face, represented in Fig. A, grew, in 1628, in a garden at the village of Weidan, between Bonn and Juliers, in Germany. For the original record of the fact, the curious may consult the volume entitled "Miscellanea Academiæ Naturæ," for 1670, page 139. It will be observed that the leaves resemble hair standing up, or feathers such as ladies wear when attired in court costume. On the round part of the root there are marks resembling eyes, nose, and mouth. By a very slight effort of imagination, the entwined roots will be thought to resemble arms and legs; and the whole bears a very close resemblance to a female figure adorned with a head-dress, sitting cross-legged, with her arms folded.

The radish represented in Fig. B grew in a sandy soil at Haarlem, and was painted from the life by Jacob Penoy, whose friend, Zuckerbecker, presented the picture to Glandorp, in 1672. From this picture an engraving was made by Kirby, from which, again, our copy is taken. Another radish, exactly resembling a human hand, was in the possession of Mr. Bisset, secretary to the museum at Birmingham, in 1802. He declared in his letter that the fingers were quite perfect, and that a large sum had been offered for it and refused.

Fig. A.

Fig. B.

Fig. C.

Mr. Kirby mentions a large radish, the thickest part of which resembled a three-legged stool; and the writer has seen a parsnip to which the same description would apply. More remarkable, was the root of the parsnip shown in our engraving, Fig. C, which represented the back of a hand so perfectly that it could not be surpassed by the best painter. This root was bought of a market-woman in the usual way, and passing from one person to another, at last fell into the hands of an engraver. Dr. Menzel testified to having seen a parsnip which exactly resembled a man, but the writer is not aware that any drawing of it was ever published.

THE FLYING DUTCHMAN.

As an instance of the wonderful things which sailors see, or believe they see, in their voyages over the ocean, it is recorded that a vessel homeward bound from Batavia in the winter season being distressed, bore up for the Cape of Good Hope. It was during the Dutch occupation of the Cape, and there was a rule forbidding vessels to enter Table Bay in winter time. The batteries fired on the offending ship and obliged her to put to sea, where she was lost, but where she is still beating about and will do so till the end of time. Another account has it that a Dutch Indiaman being baffled continuously for several weeks in its endeavours to get into Table Bay, the captain swore with a dreadful oath that he would get in though he tried till the judgment day; that he was taken at his word, and was condemned to beat up incessantly for the bay, which, however, he may not enter. The *Flying Dutchman* is seen in the worst weather, when other ships can scarcely show a yard of canvas to the wind, carrying a press of sail; and in calm weather he is seen, when other ships have everything set scudding, under bare poles. To see him is deemed unfortunate; to answer his invitation to lie to while he sends a boat on board with a letter to be sent home, is considered fatal.

The following wonderful narration is from the log of H.M.S. *Leven*, employed with the *Barracouta* in 1823 in surveying in the neighbourhood of the Cape. The *Leven* was off Point Danger between Algoa and Simon's Bay, when she saw the *Barracouta* about two miles to leeward of her. Some surprise was expressed on board the *Leven*, as the *Barracouta's* orders required her to be far distant from the spot at the time. There was no doubt, however, in the minds of any as to the vessel, and the *Leven* tried to close with her but could not. The stranger lowered a boat, but night came on and nothing more was seen of ship or boat. A week afterwards, when the *Barracouta* rejoined her consort, it was found from the log that she was, on the evening in question, three hundred miles from the *Leven*, and could not possibly have been seen. It was further ascertained that she had not lowered a boat during the whole of that day. On another occasion the *Leven* witnessed a similar phenomenon, the mystery of the boat being repeated, and being taken by the sailors as an undoubted proof of the stranger being the *Flying Dutchman* himself. The *Leven* did not wait for the boat, but hove away and went on her voyage.

At another time a homeward-bound vessel being caught in a gale near the Cape, saw coming down towards her under a press of canvas, a large, old-fashioned ship, which seemed to be indifferent to all the winds that blew. In spite of the weather, the stranger made straight for the Indiaman, which had been made snug, and steered as though she would pass under her quarter. Her decks were seen to have men upon them, and she herself flew with the rapidity of lightning. The people of the Indiaman were preparing to hail, when the stranger disappeared as suddenly as she had shown herself, and was seen no more. There are many like stories, but the above is given on the authority of Mr. Montgomery Martin, who had made many voyages, and was too much practised in sea sights to be taken in by appearances. For myself—

> "I know not how the truth may be,
> I say the tale as 'twas said to me."

THE HISTORY OF A WONDERFUL DIAMOND.

THE KOH-I-NOOR.

The Koh-i-noor, or Mountain of Light, is stated by the Hindoos to have been discovered in the mines of Golconda, more than three thousand years ago, and to have been originally in the possession of Kama, King of Auga. Another version states that it was stolen from one of the kings of Golconda by a treacherous general named Mininrola, and presented by him to the Great Mogul, Shah Jehan, the father of Aurungzebe, about the year 1640. It was then rough and uncut, and about twice its present size; but Shah Jehan gave it to a diamond-worker, who cut it so badly that he wasted half of it, and did not display its lustre to good advantage. The Mogul—who was in a justifiable rage—instead of paying the jeweller for his work, fined him ten thousand ducats. About two hundred years ago, Tavernier, the French traveller, saw the Koh-i-noor in India, and described the admiration and amazement it always excited. From that time until it came into the possession of the Khan of Cabul, at the commencement of the present century, the Koh-i-noor changed hands very often. Runjeet Singh obtained it from the Khan in a mean and abominable way. He had heard that the Khan of Cabul had the finest and purest diamond ever seen, and he determined to possess it. The Khan was invited by the intending thief; he arrived at the court of his host with—not the diamond, but a clever imitation. Once in Runjeet Singh's power, that despot immediately demanded the gem. It was reluctantly given up, and sent to the court jeweller's to be cut. Runjeet Singh soon received intelligence that the stone was comparatively worthless. He was so enraged at this, that he ordered the Khan's palace to be ransacked from top to bottom, to find the missing treasure. At last a slave betrayed his master, and showed the diamond lying under a heap of ashes. Runjeet carried it off in triumph, and subsequently decked himself, and occasionally his horse, with its splendid brilliancy.

When he died, the gem passed into the hands of his successors; and in 1850, when we conquered the Punjaub, the Koh-i-noor was among the spoil. It was brought to England in the *Medea*, and presented to Her Majesty the Queen by the East India Company.

The Koh-i-noor was pronounced to be badly cut, and the court jeweller entrusted it to Messrs. Coster, of Amsterdam, to re-cut—a work that occupied the labours of thirty-eight days of twelve hours each. The late Duke of Wellington became an amateur diamond-cutter for this memorable occasion, and gave the first touch to the work. The wonderful stone was exhibited, re-cut, in 1862, and a model of it may be seen in the British Museum.

CURIOUS DISSECTION
OF THE OLD AND NEW TESTAMENTS.

SHOWING THE NUMBER OF BOOKS, CHAPTERS, VERSES, WORDS, LETTERS, &C.

In the Old Testament.			In the New Testament.			Total.
Books.........	39	...	Books	27	...	66
Chapters ...	929	...	Chapters	260	...	1,189
Verses	23,214	...	Verses	7,959	...	31,173
Words	592,439	...	Words	281,258	..	773,697
Letters	2,728,100	...	Letters.........	838,380	...	3,566,480

Apocrypha—chapters, 183; verses, 6,081; words, 152,185.

The middle chapter and the least in the Bible is Psalm cxvii.

The middle verse is the 8th of Psalm cxviii.

The middle line is in 16th verse, 4th chapter, 2 Chronicles.

The word *and* occurs in the Old Testament 35,543 times; in the New Testament, 10,684 times.

The word *Jehovah* occurs 6,855 times.

The middle book is Proverbs.

The middle chapter is Job xxix.

The middle verse would be in the 2nd of Chronicles, 20th chapter, between the 17th and 18th verses.

The shortest verse is the 1st of Chronicles, 1st chapter, and 25th verse.

NEW TESTAMENT.

The middle book is 2 Thessalonians.

The middle chapter is between the 13th and 14th of Romans.

The middle verse is the 17th of Acts xvii.

The shortest verse is the 35th of John xi.

The 21st verse of the 7th chapter of Ezra contains all the letters of the alphabet.

The 19th chapter of the 2 Kings, and the 37th of Isaiah, are alike.

It is stated that the above calculation took three years to complete.

Wonders of Animal Life.

INFLUENCE OF A SOLAR ECLIPSE ON ANIMALS.—During the annular eclipse of the sun in 1764, the agitation and cries of domestic animals continued for a great part of the time, notwithstanding its light was not more diminished by it than it would have been by the interposition of a dark, thick cloud; the difference of the heat of the atmosphere was scarcely sensible. What impression, then, can animals have of the nature of the body which eclipses the sun? How are they able to divine that it is a different circumstance from the sun's being veiled by a cloud which intercepts the light? The writer of this paragraph confesses to have had very considerable doubt of the veracity of this statement up to 1857 or 1858, in one of which years a partial eclipse of the sun occurred, and he witnessed precisely the same phenomena. He was in the public room of an inn in the country, which was situated on the border of a common. In front of the inn were a horse-trough and railings, and a large number of fowls, ducks, and pigeons collected about; on the common beyond, horses, cows, and sheep grazing. Several minutes before the eclipse took place, and while the light had in no degree diminished, all the animals exhibited symptoms of languor and bewilderment; the fowls, ducks, and pigeons perched languidly on the railings around; the sheep and cattle in the distance suspended their meal and appeared stupefied. In a few minutes the eclipse passed away, and the animals resumed their ordinary state.—*Dolomieu, in the "Dissertation on the Earthquake in Calabria."*

A STRANGE HORSE.—There is at present a fine horse in the ménage of the Earl of Pembroke, at Wilton House, which, when worked, sweats exceedingly on one side, whilst on the other he is perfectly dry and cool; and
operation of nature is so exact, that it describes a palpably regular line from the top of the nose up the middle of the face, between the ears, and along the back to the tail.—*Oracle*, Nov. 1789.

THERE is at this present time at Brussels, a horse fond of flesh, and particularly of raw mutton. A short time ago it got out of its stable, and devoured two breasts of mutton hanging up at a butcher's shop.—*Times, Sept. 16th*, 1836.

SINGULAR TASTE OF AN ASS.—There is now in the possession of Mr. Walton, farmer, of Great Lever, near Bolton, a male ass which is known to be nearly fifty years of age. He is named "Billy," and prefers tobacco to any other luxury; he is likewise very fond of a pinch of snuff. Our informant has within these few days seen Billy masticate a large quid of pigtail with as much gusto as any Jack tar in Her Majesty's service. When he had finished the tobacco, a pinch of strong rapee was

administered, which Billy snuffed without the least demur, and curling up his olfactory organ, delivered one of those charming solos so peculiar to his species. Billy is chiefly employed in carrying milk from his master's farm to Bolton; and if Mr. Walton has any other business to transact in the town, he can leave Billy with security at the door of any customer, whence he will not budge an inch until he hears his master's voice. Billy is invariably accompanied on his journeys to Bolton by a small cur dog, which is so attached to him, that in the absence of Mr. Walton, he takes his station close to Billy, and will not suffer any stranger to come near him.—*Monthly Review,* vol. xxii., p. 156.

A TAME WOLF.—M. de Candolle, Lecturer on Natural History at Geneva, related this story:—"A lady near Geneva had a tame wolf which seemed to have as much attachment to its mistress as a spaniel. She had occasion to leave home for some weeks. The wolf evinced the greatest distress after her departure, and at first refused to take food. During the whole time she was absent he remained much dejected. On her return, as soon as the animal heard her footsteps, he bounded into the room in an ecstacy of delight. Springing up, he placed one paw on each of her shoulders, but the next moment he fell backwards, and instantly expired."—*O'Brien's "Round Towers of Ireland," page* 468.

WHEN wolves cross a river, they follow one another directly in a line, the second holding the tail of the first in its mouth, the third that of the second, and so of the rest. This figure was chosen by the Greeks to denote the year composed of twelve months following one another, which they denominated *Lycabus*, that is, the march of the wolves.—*Abbé Pluché.*

THE WONDER OF LIFE.

TO ascertain how long all can live, MM. Buffon, Cuvier, Flourens, and the rest of those *savans* who have turned their attention to the all-important problem, proceed to reason by analogy. The duration of life with the horse and with other animals of the higher species, is proportionate to the time expended in their growth. "Man, who takes fourteen years to grow," says Buffon, "may live six or seven times as long." This idea is doubtless correct, but Buffon's statement as to the period of growth in man is not so. Man grows for more than fourteen years. If he lived seven times as long, the ordinary life would be only ninety-eight, which, always supposing a state of perfect health, is not, even in this sophisticated age, extraordinary.

M. Flourens has, in our opinion, improved on the working out of Buffon's idea. All the larger animals, he observes, live *five* times as long as the time expended by them in reaching maturity. Thus:-

The camel grows for	8 years,	lives	40 years.
Horse	5 ,,	,,	25 ,,
Ox	4 ,,	,,	15 or 20
Lion	4 ,,	,,	20 ,,
Dog	2 ,,	,,	10 to 12
Man			100 or more.*

By a physical analogy, therefore, the ordinary life of a man should be one hundred years at least. The term fixed by David, threescore years and ten, wants thirty of this; the average life of men of the upper classes, fifty; of tradesmen, business men, and hard-workers, fifty-five; of the labouring classes, sixty-five; of the factory-workers, seventy. Man in a purely unsophisticated state is clearly fitted to live to a much greater age than he commonly attains; but nature, ever wise, in shortening his existence does not deduct from any one term, but from the whole, in nearly equal proportions. It used to be an old saying amongst brainless wits that "a short life and a merry one is the life to live." Nothing can be more absolutely untrue. A short life in their sense is scarcely a merry one; the pace kills. If we live fast, if we exhaust ourselves in any one period, that period next succeeding is shortened. In short lives, puberty and maturity are reached early, then comes old age, and then exhaustion and death. Knowing how fast these succeed each other in our manufacturing districts; how girls become women at thirteen, mothers at fourteen, and grandmothers at thirty, if they attain that age—it is quite refreshing to read and believe M. Flourens' scale of the development of the periods of man's life.

The various apparently authentic instances of age which we have, will also, when combined, form an almost unanswerable argument in our favour. They are not simply the exceptions which prove the rule. They are sufficiently numerous, and accompanied by circumstances so similar each to each, that they form a rule themselves.

Galeria Capíola, an actress, whose age at her debût is not exactly known, appeared upon the stage ninety-nine years after, at the dedication of the theatre by Pompey the Great, as a wonder of longevity; and this was not all, for she was shown a third time at the solemnities for the life and health of Augustus. William Postel, a Frenchman, lived to nearly 120, and the hair on his upper lip showed not the least sign of changing colour, but remained coal-black to the last. It is not uncommon to see the moustache and eyebrows black, while the hair is grey.

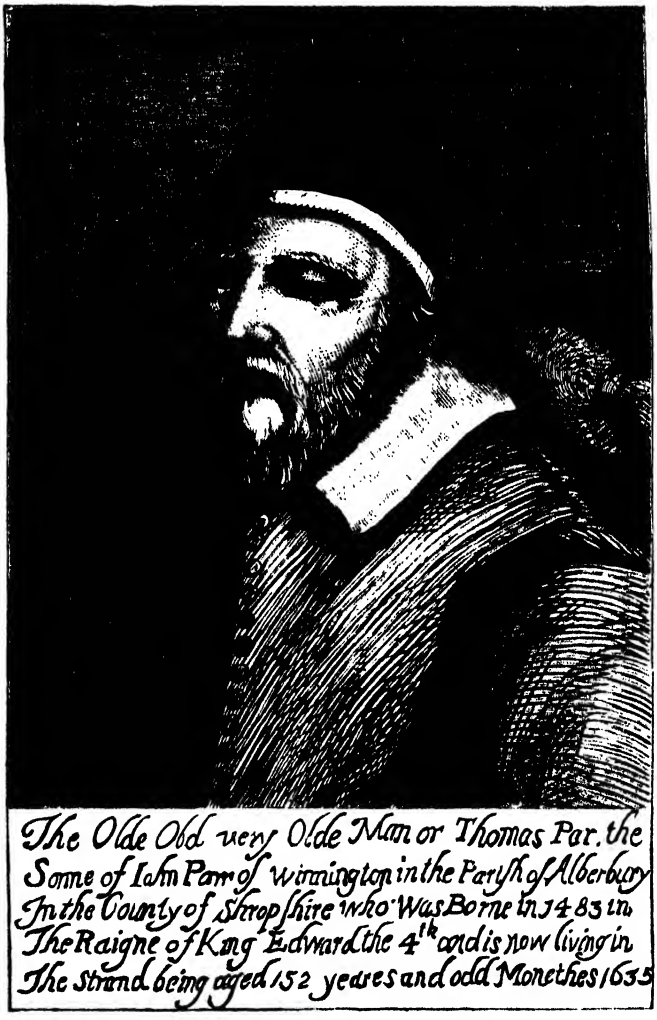
In the times of Vespasian, father and son, Pliny tells us there were found in the roll at one of the taxations fifty-four persons of 100 years of age, fifty-seven of 110, two of 125, four of 130, as

* Flourens, "Sur Longevité Humaine." Paris, 1862.

many of 135 or 137, and last of all, three men of 140. The great physician Galen, who flourished about the time of the Emperor Antoninus, is said to have lived 140 years. From the time he was twenty-eight he was only seized with a sickness of a day's duration. The rules he observed were, not to eat or drink his fill, not to eat anything raw, and always to carry some perfume about him. James Sands, of Horborne, in Staffordshire, of whom Fuller makes mention in his "Worthies," lived 140 years, and his wife 120. He outlived five leases of twenty-one years, each made to him after he was married.*

Raleigh, in his "History of the World," says, "I myself knew the old Countess of Desmond of Inchequin, in Munster, who lived in the year 1589 and many years since, who was married in Edward IV.'s time, and held her jointure from all the Earls of Desmond since then; and that this is true all the gentlemen and noblemen in Munster can witness. The Lord Bacon casts up her age to be 140 at the least, adding withal, *Ter per vices dentisse*, that she recovered her teeth (after the casting of them) three several times."

Thomas Parr, whose portrait we give, son of John Parr, born at Alberbury, in the parish of Winnington, in Shropshire, was born in the reign of King Edward IV., A.D. 1483; at eighty years he married his first wife Jane, and in the space of thirty-two years had but two children by her, both of them short-lived, the one lived but a month, the other but a few years. Being aged 120, he fell in love with Katherine Milton, by whom he had his last child. He lived to about 152 years. Two months before his death he was brought up by Thomas, Earl of Arundel, to Westminster; he slept away most of his time. Change of air and diet, neither of which apparently agreed with him, added to the trouble of many spectators, are supposed to have hastened his death, which happened at Westminster, November the 15th, 1635, and he was interred in the Abbey church. The portrait with inscription which we annex, is copied from a very old engraving.



There is a curious story told of one Henry Jenkins, of the parish of Bolton, in Yorkshire, being produced as a witness at the assizes there, to prove a right of way over a man's ground. He then swore to nearly 150 years' memory; for at that time he said he well remembered a way over that ground. And being cautioned by the judge to beware what he swore, because there were two men in court, each above eighty years of age, who remembered no such way, he replied that, "Those men were boys to him." Upon which the judge asked those men how old they took Jenkins to be? They said they did not know, but that he was a very old man when they were boys. Dr. Tancred Robinson adds concerning him that he could remember Henry VIII. and the fight at Flodden Field, at which time he was twelve years old. He died on the 8th of December, 1670, at Ellerton-upon-Swale, aged 169 years.

* This seems an undoubted proof of age.

Wonders of Humanity.

THE SPOTTED NEGRO BOY.—The spotted boy was born in 1808, in the island of St. Vincent. His father and mother were Africans, and both perfectly black. Not only the child's skin but his hair were spotted dark brown and white. He was brought to Bristol at the age of fifteeen months, when Richardson entered into an engagement to exhibit him. The showman became very fond of the child, and had him christened George Alexander Grattan. He died before he reached his fifth year, and was buried at Great Marlow in Buckinghamshire.

A MOUNTAIN OF FAT. LAMBERT'S EXHIBITION BILL.—"*Exhibition.* Mr. Daniel Lambert, of Leicester, the heaviest man that ever lived; who, at the age of thirty-six years, weighs upwards of fifty stone (fourteen pounds to the stone), or eighty-seven stones four pounds, London weight, which is ninety-one pounds more than the great Mr. Bright weighed. Mr. Lambert will see company at his house, No. 53, Piccadilly, next Albany, nearly opposite St. James's Church, from eleven to five o'clock. Tickets of admission one shilling each." The date of the bill is 1806. Lambert died suddenly on July the 21st, 1809; he went to bed in perfect health at night, and died early the next morning.

IN the year 1711 there was brought to London a tall, black, wild man, who had been taken savage in the woods near Bengal in the East Indies; he was stark naked, and he ran very swiftly; he was covered all over the body, arms, and hands, with a very thick, long black hair; could never learn to speak, read, nor write. He was sold to a company of rope-dancers, and learned of them to dance upon the straight rope with a pole in his hands. He outdid his masters in capering, and leaped upon a rope without a pole; he walked upon a small rope no bigger than a penny cord, and swung on it, holding to it by his hands and toes.—*Sloane MS.*, 5246.

ST. JEROME states that he saw Scotchmen in the Roman armies in Gaul, who fed on human flesh as a delicacy.

CANNIBALS who have tried both, assure us that white men are finer flavoured than negroes, and Englishmen than Frenchmen.—*Langsdorff.*

THE HUMAN BODY.—The muscles of the human jaw exert a force of 534 lbs. The quantity of pure water which blood contains in its natural state is very great, it amounts to almost seven-eighths. Kiel estimates the surface of the lungs at 150 square feet, or ten times that of the external body. The blood is a fifth the weight of the body. A man is taller in the morning than at night to the extent of half an inch or more, owing to the relaxation of the car ges. There is iron enough in the blood of forty-two men to make a ploughshare of twenty-four pounds or thereabouts. The human brain is the twenty-eighth part of the body, but in the horse the brain is not more than the four-hundredth.

HEROISM OF A MAID-SERVANT.

THE following story of heroism in humble life, and in circumstances by no means calculated to inspire romantic feelings of devotion, is not surpassed by any occurrence that we can recal to mind in the histories of princes and kingdoms. Nothing but real greatness of heart, combined with the most tender sympathy, can account for an act which is almost without a parallel.

A common sewer, of great depth, had been opened at Noyon for purposes of repair, and was carelessly left unprotected during the night. Four men, passing that way in the dark, fell in, and it was near midnight before their perilous situation became known. Among all who crowded to the opening, not one was found courageous enough to descend to the assistance of the unfortunate wretches, who appeared already in a state of suffocation from the poisonous vapour they were compelled to breathe. The wives and children of the men in vain besought the bystanders for aid, until Catherine Vasseur, the daughter of a French peasant, and at that time only seventeen years of age, appeared on the scene. Moved by sympathy, and careless of the danger to herself, the young girl insisted on being lowered into the sewer, and, having taken a rope with her for the purpose, she succeeded in fastening it round two of the men, and, assisted by those above, she had the happiness of restoring them to their wives and families. Again she descended, and now her breath began to fail her. She succeeded, however, in fastening the rope round the body of a third man, and, in a fainting condition, had sufficient presence of mind to knot up the end with her own luxuriant tresses. We may imagine the astonishment of the dastardly fellows above when they drew the man to the surface, and found the all but inanimate body of Catherine swinging by her hair to the end of the rope. Fresh air and stimulants soon restored the brave girl, and the third man lived also; the fourth perished.

So great was the admiration excited by Catherine Vasseur's devotion, when the news spread through Noyon, that a solemn Te Deum was ordered by the bishop, and the members of the corporation marched in procession to the church. Nor was this all. The Duke of Orleans, the Bishop of Noyon, and the magistrates, tendered her the public thanks of the town, and she was presented with a civic crown, and an emblematic medal commemorative of her heroism and self-devotion.

SEA-DUST.

PEOPLE laughed at the man who said that the fish he had hooked "kicked up such a *dust in the water.*" Perhaps they will laugh at the heading to this article; but there will still be "sea-dust," nevertheless.

We have heard of water-spouts, of showers of fish, of salt rain, and many other curiosities which present themselves in the atmosphere, but to assert that there is such a thing as sea-dust is to transcend all reasonable bounds. The evidence, however, in favour of its existence is exceedingly powerful—indisputable, in fact—and this is the story told by eye-witnesses. They say that in certain parts of the world, notably about the Cape de Verde Islands, there are constantly met at sea, several hundreds of miles away from land, thick, yellowish-red fogs, not unlike London fogs in November. These fogs obscure the atmosphere, and are very injurious to navigation, but they have not the baleful odour of their London prototypes, nor do they affect the breathing in the same way. Whilst sailing through them, it is found that the ship, sails, and rigging are covered with a fine, impalpable powder, which falls as dry rain, and covers the surface on which it falls sometimes to the depth of two inches. In colour, it is of a brick-dust hue, sometimes of a light yellow, and it feels between the teeth like fine grit, such as might be blown into the mouth on a windy day in March. No place is free from its presence, its fineness giving it power to penetrate everywhere. The sea, while the dust is falling, looks as though it had been peppered, and is discoloured for some distance down. Sometimes the dust comes in a shower, and passes off again. The fogs are nothing but vast quantities of the dust suspended in the air.

It is not only in the vicinity of the Cape de Verde that this wonderful dust is seen. In the Mediterranean, on the northern parts of Africa, in the middle of the Atlantic, it has been reported. It is invariably the same in kind and appearance, and examination under microscopes has proved the identity of say Cape de Verde sea-dust with Mediterranean sea-dust. All this is very remarkable: dust falling in clouds, no land within some hundreds of miles, nothing visible which could possibly account for the curious phenomenon. Sand-spouts there are in sandy deserts, and showers of sand taken originally from spots whereon the carrier wind has left its mark; but here there is no desert from which the sand can be rapt, and the wind, so far from being boisterous, or disposed to play whirlwind pranks, is light and steady, blowing ships along at a calm five knots an hour.

In connection with these facts, hear what Humboldt says of the sight he saw in the dry river beds and sandy valleys of Central America:—"When beneath the vertical rays of the bright and cloudless sun of the tropics, the parched sward crumbles into dust, then the indurated soil cracks and bursts, as if rent asunder by some mighty earthquake; and if at such a time two opposite currents of air, by conflict moving in rapid gyrations, come in contact with the earth, a singular spectacle presents itself. Like funnel-shaped clouds, their apexes touching the earth, the sands rise in vapoury form through the rarefied air in the electrically charged centre of the whirling current, sweeping on like the rushing water-spouts which strike such terror into the hearts of the mariner. A dim and sallow light gleams from the lowering sky over the dreary plain. The horizon suddenly contracts, and the heart of the traveller sinks with dismay as the wide steppe seems to close upon him on all sides. The hot and dusty earth forms a cloudy veil which shrouds the heavens from view, and increases the stifling oppression of the atmosphere."

It is believed by scientific men that these dust-clouds of Central America are, in all probability, closely connected with the phenomenon of sea-dust.

THE WONDERS OF THE MAGNET.—II.

IN the early years of this century the study of magnetism received a mighty impulse, from the discovery of a Danish philosopher that the closest possible connection existed between electricity and magnetism. If a bar of soft iron be wrapped round with an insulated copper wire—that is, a wire covered with silk or cotton thread—and a current of electricity be sent along it, the electric fluid is compelled to traverse the whole length of the wire, for the thread prevents each coil from touching its neighbour; and as electricity of this species is incapable of running along either cotton or silk, and as incapable of leaping from one wire to the other if there be the least space between them, the current is caused to circulate round the piece of iron, and when this is the case, the iron becomes a strong magnet, and the moment the current ceases to run, that moment the iron also

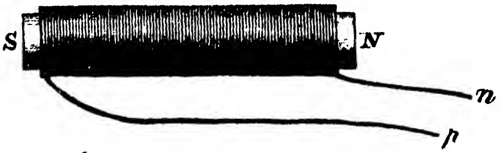


Fig. 1.

ceases to be a magnet. Fig. 1 is an electro-magnet of the simplest form; *s n* is the soft iron core, *p* and *n* are the ends of the insulated wire, which is wound continuously on the iron bar. These ends are

attached to the first and last plate of a galvanic battery, and the instant the current traverses the wire, *s n* becomes a strong magnet.

The more coils of wire wrapped round the bar, and the stronger the current, the stronger will be the magnet, up to a certain limit.

Now there is another peculiarity about this magnet. If it were suspended so that it could move freely, it would point north and south, precisely as a compass-needle; and, moreover, a very few experiments will convince us that which end of the bar shall be the north pole entirely depends upon the direction in which the current goes round the iron core. If you take out your watch, and suppose that the pin upon which the hands are fixed is the end of the iron core, then if the current be passing round it in the direction in which the hands move —that is, from left to right—that end of the core will be the south pole.

This may not at first sight appear to be very wonderful. But though the fact itself may not excite any great wonder, yet at least it is a step which will lead us to appreciate a truth which cannot but fill us with astonishment.

Suppose, now, we extract the iron core from the electro-magnet, leaving the coil of wire, and suppose

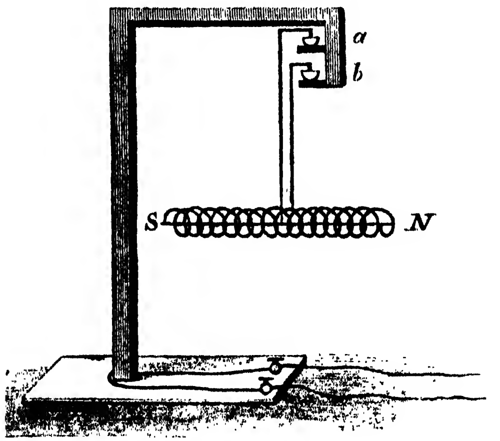


Fig. 2.

we suspend it as in this illustration (Fig. 2), so that the coil is able to swing round with perfect ease.

Two little cups, *a* and *b*, are supported as you see. The two ends of the wire coil are bent back, and brought away at the centre of it; they are then carried up, and their extremities bent so as to dip into the cups, which are filled with mercury. Each cup is connected with a wire, which is carried down the upright frame, to a screw in the base of the stand, where it meets the wire from the battery carrying the current. A glance will show you that by this contrivance the coil can have a current sent through it, and yet be able to swing round precisely as a suspended needle. Now let the current run, and what is the result? The coil behaves in all respects as if it were a magnet. A permanent magnet will attract one end and repel the other, and it will place itself north and south, just as a compass-needle.

We need one other fact ere we can explain the wonder of magnetism.

It is not a difficult thing to show that a wire which is conducting a current of electricity will attract another wire, which is also carrying a current in the same direction, whilst it will repel it if the current be going in the opposite direction. Thus we may say generally that if two currents of electricity are near each other, they will do all they can to induce each other to go in the same direction. If the wires which carry the opposite currents be free to move as they wish, one of them will turn completely round, so as to make the current which runs along it go in the same direction as that which traverses its neighbour. Here, then, is the explanation of magnetism: round every particle of iron runs an electric current. In a non-magnetised piece of iron these currents are in utter disorder, but the moment an electric current circulates all round the bar, this great current induces the myriads of tiny currents which are rushing round the particles of the iron all to go in the same direction, and to look in the same way.

When this piece of iron is then brought near another piece, it has the same effect upon all the native currents in this second piece—they all arrange themselves in the same direction. But since currents which are travelling in the same direction attract each other, so these pieces of iron, compelled by the currents, are drawn together.

Now take a nail in your hand. It looks a dead, lifeless thing; but does it not become a wonderful thing when you know that it is quivering with electric life? Millions of electric currents, in motion as swift as thought, are speeding round the innumerable particles which compose the nail.

And herein we find a reason why compasses point to the north. Round the earth, above us, there in those quiet heavens, a current of electricity is moving in the same direction as the sun; or it may be that our planet home is sailing in a sea of electric fluid, and by her own motion produces the current. Yet there is the current, and it influences every current which surrounds a magnet-needle, and induces it to place itself so that the minute current which circulates round the needle may be parallel to the mighty current which encircles the earth, and hence is it that all compass-needles point in the same direction.

Now the reader will be able to understand why the great masses of that particular iron ore which is capable of being magnetised become "lodestone." The great current of the earth influences the magnetisable mass, and it becomes magnetised.

OLIVER CROMWELL'S PORTER.

GIANTS.

One of the earliest giants of whom we have any individual record is Og, the King of Bashan, so familiar to us from the mention of him in the Psalms; and he was, it seems, about nine feet high, although some Eastern legends have made him many miles in height. Ishbi-benob, Goliath, and the children of Anak are also mentioned in Scripture as being of exceptional height; Saul also must have been an immensely tall man, as the reader will find on referring to I. Sam. ix. 2; and even father Adam himself is represented by Rabbinical writers as of fabulous and extraordinary height.

In heathen mythology, too, we find in the tales of the Titans and the Cyclops a strong belief in giants. The Greeks, indeed, were very fond of making out all their heroes to be tall men, and Orestes was, on their authority, nearly twelve feet in height. The Greeks and Romans held also the belief, common to almost all nations, that they were but pigmies to the gigantic races which had preceded them; and, indeed, if the human race had gone on degenerating as much as they supposed it to have done, we should by this time have been a race of the merest dwarfs.

The earliest stories of giants in these islands tell of the bones of very tall men being discovered in various parts of the country, and of huge stone erections supposed to be the work of giants, as

well as of giants' caves. Some instances of such things must be within the experience of every one. But the stories of gigantic heroes must always be received with caution, inasmuch as many fossil remains have turned out on investigation by scientific men to be the bones of megatheria, and other antediluvian monsters, and not of human beings at all.

Gog and Magog, the renowned giants of the City of London, are instances of that curious custom of all nations, which almost invariably associated giants with City pageants and with civic rule. We may mention here, by the way, that the original names of the two giants were Gogmagog and Corinæus, the first of these names now being divided and made to do duty for both figures. In this country, as well as on the Continent, it was the custom to carry pasteboard giants in holiday processions, and gigantic figures are placed in the halls of justice in many German towns, symbolical of the power of the municipality.

Our modern nursery stories of giants, who are very useful in legendary fiction, seem to have been handed down to us from the very earliest ages. Jack the Giant-killer comes to us from Scandinavia, as well as from Wales, and Jack and the Bean-stalk is only a reproduction of one of the beautiful myths of the weird mythology of the Norland. All these giants in old stories seem to have been made to slave for the weal of mankind in a good-natured way; and they were also represented as by no means impervious to softer feelings, and very ready to fall in love. There is a pathetic story of a Cornish giant who was in love with St. Agnes, and who was ordered by the cruel lady to fill a hole in the cliffs with his body. This hole opened into the sea, and the poor giant thus fell a victim to his unrequited attachment.

No race of giants, in one sense of the word, however, can be proved to exist. We know that the Egyptian mummies, in cases where the exact height can be ascertained, are the remains of people no taller than ourselves. The Patagonians are not so tall as many travellers have asserted, their average height, according to a recent and reliable authority, being between six and seven feet.

We have spoken before of the mental characteristics of giants, and it is curious to find them very often deficient in courage. An amusing instance of this occurred when an empress of Austria, for the gratification of an odd fancy, had all the giants and dwarfs in her empire assembled together. It was at first thought that it would be necessary to protect the dwarfs against the giants, but precisely the opposite course turned out to be required. The dwarfs bullied and teased the giants to such an extent that the big men had to be protected by sentinels from their tiny persecutors.

Oliver Cromwell had a giant porter, whose sur name is not on record, but whose Christian nam was Daniel. This Daniel was a great student he especially loved mystical works, and these ar supposed to have sent him mad. He was many years in Bedlam, and as there was no chance of cure for him, he was allowed to have his librar there. He had a Bible given him by Nell Gwynn Daniel used to preach, and, as has been reported with great zeal and fervour. Our illustration show him standing at the gate reading his Bible, un moved by the jeers of the mocking band of Cavalier in front of him.

A still more curious whim than that o Austrian empress, was the fancy of Frederick William of Prussia to make what might fairly be called a regiment of giants. None of the soldiers in this corps of guards were less than seven feet high, and a king of Poland, who was of a fair height, could only reach the chin of one of them with his outstretched arm. Cornelius Magrath was a very famous Irish giant who flourished in the middle of the last century, and concerning whose origin there is a curious story told. He was seven feet eight inches high, and it is said that Bishop Berkeley had found him when an orphan child, and brought him up on certain dietary principles with a view of inducing an abnormal height. It is probable, however, that the Bishop had only benevolent intentions, and no idea of any artificial production of a giant.

Another celebrated Irish giant was Charles O'Brien, who measured eight feet four inches. The way in which he advertised himself was very amusing, heaping laudatory epithets upon himself in a thoroughly Hibernian manner. O'Brien was in great fear lest the surgeons of the period should get hold of his body, and at his death he desired to be thrown into the sea. The doctors, however, were too wary for him, and it is said that William Hunter, the anatomist, gave upwards of five hundred pounds for his body—certainly an enormous sum. O'Brien was also the assumed name of one Patrick Cotter, another gigantic Irishman, who used to light his pipe at the street-lamps in Northampton.

Big Sam was the *sobriquet* of a gigantic Scotchman who was porter to George IV., and used to look over the gates of Carlton House; being, according to some accounts, nearly eight feet high.

Of the giants who have appeared in our own day, we must notice Joseph Brice, a Frenchman, who was seven feet seven inches high, and after exhibiting himself on his own account in 1863, was brought out as "Anak," by Professor Anderson, a few years afterwards. Chang Woo Gow, the Chinese giant, appeared about the same time, and at the age of nineteen was seven feet nine inches in height.

CURIOUS CUSTOMS.

BEATING THE BOUNDS.

THE Christian custom of perambulating parishes in Rogation Week appears to have been derived from a still older pagan observance. "Before the Reformation these parochial perambulations were conducted with great ceremony," says "The Book of Days." "The lord of the manor, with a large banner, priests in surplices and with crosses, and other persons with banners, hand-bells, and staves, followed by most of the parishioners, walked in procession round the parish, stopping at crosses, forming crosses on the ground, 'saying or singing gospels to the corn,' and allowing 'drinkings and good cheer,' which was remarkable, as the Rogation days were appointed fasts. From the different practices observed on the occasion, the custom received the various names of *processioning*, *rogationing*, *perambulating*, and *gauging the boundaries;* and the week in which it was observed was called *Rogation Week* [from the Latin *Rogare*, to beseech]; *Cross Week*, because crosses were borne in the processions; *Grass Week*, because the Rogation days being fasts, vegetables formed the chief portion of diet."

At the Reformation a homily was prepared for the occasion, and the rector, vicar, or curate, and the substantial men of the parish, were to walk about the parishes, and on their return to the church pray together.

Persons beating bounds were to be justified in going over the old ground, utterly regardless of the wishes of the owners of the property over which they walked. If a canal were cut through the boundary of a parish, some one must pass through it; or if a house had been built on the line, it must be entered and walked through. A house in Buckinghamshire still exists with an oven passing over the boundary. A boy generally was placed inside; but on one occasion the oven was found full of fagots—in fact, in a very advanced state for the process of baking. Finally, after frightening several boys by asking them to take up the usual position, the officers made one of them scramble over the top, and the boundary right was considered upheld.

At the beginning of this century, as the bounds were being beaten in the parish of St. George's, Hanover Square, a nobleman's carriage, empty, was standing upon the boundary line. The principal churchwarden ordered the coachman to move on a little, but he persisted in his right to remain where his master had ordered him. The churchwarden (who was himself a nobleman) opened the carriage door and coolly walked through, followed by the whole procession, amongst which were not only sweeps, scavengers, shoe-blacks, &c., but roughs of the worst description.

Wonders of the Ocean.

THE SARGASSO SEA.

THERE is a sea in the middle of the ocean! Astonishing as the statement sounds, it is literally true. The limits of the sea are as well defined as those of any other known collection of water; its characteristics are so special that no one can mistake them.

When Columbus, on his first voyage, had got some distance to the westward of the Canary Islands, he was amazed one morning to find his ships in an undulating meadow. As far as he could see, the water was covered with a greenish-yellow plant, which appropriated the surface of the sea as thoroughly and effectually as water-lilies cover a pond. The wind was light but steady; there were not any birds to indicate the proximity of land, neither was there any apparent cause for such a collection of weed. The sailors, already scared by the persistence of the wind from one quarter—they had got into the trade-winds—looked upon the weed before them, behind them, and on either side of them, as infallible proof of their imminent destruction. The Almighty, they said, was angry at their impious attempts to pry into his secrets in the west, and had given them over to the devil, who was causing a wind to blow that would for ever prevent their return to Spain, and now had brought them into a snare such as sailors most dread—shallows extending too far beyond the land to allow of ships or men being saved. The commander could not explain the sight he saw, and might have thought with his men that the weed was the cast-off clothing of some dangerous rocks which lay a short distance down, ready to tear and rend them. The deep sea lead-line was hove, but no bottom was found. The ships kept on their westerly course, still sounding and still getting no bottom, till, in a few days they drew clear of the weed and came where the broad ocean was all around them again, unencumbered by aught but the ships of the explorers.

Ever since the day Columbus saw the weed, and probably for thousands of years before he saw it, the Sargasso Sea—such is the name of the weedy sea—has existed. Its boundaries may be indicated by tracing a triangle, of which the three corners are represented by the Azores, the Canaries, and Cape de Verde. Within those limits the sea is still bottomless, and is clothed on its surface with a garment of vegetable material, so thick as to retard the progress of vessels sailing through it. Steamers avoid it when they can do so, because of the fouling of their screws and paddles by the weed; but sailing-vessels outward bound to the West Indies, South America, the Cape, &c., must needs pass through it. Sometimes a great storm, proceeding from some point outside the charmed

triangle, causes its effects to be felt within the triangle, and scatters the weed more or less out of bounds. But usually there is a placid condition of things in the Sargasso Sea: the wind is light, the sky is clear, the water never rages, and, unless such a storm as has been mentioned should disturb the wonted calmness of the sea, the surface, over several degrees of latitude and longitude, is covered, as in the day when Columbus saw it, with the weed Sargassum, which springs from an apparently inexhaustible source.

CURIOUS RHYMES.

RHYMES ABOUT THE CUCKOO.—

In April
The cuckoo shows his bill;
In May
He is singing all day;
In June
He changes his tune;
In July
He prepares to fly;
In August
Fly he must.

CURIOUS STANZAS ON NAIL-CUTTING.—

A man had better ne'er been born,
Than have his nails on a Sunday shorn.
Cut them on Monday, cut them for health;
Cut them on Tuesday, cut them for wealth;
Cut them on Wednesday, cut them for news;
Cut them on Thursday for a pair of new shoes;
Cut them on Friday, cut them for sorrow;
Cut them on Saturday, see your sweetheart to-morrow.

A CURIOUS WILL.—The following last will and estament was proved on the 5th of July, 1737:

This fifth day of May,
Being airy and gay,
To hip not inclined,
But of vigorous mind,
And my body in health,
I'll dispose of my wealth;
And of all I'm to have
On this side of the grave
To some one or other,
I think to my brother.
But because I foresaw
That my brothers-in-law,
If I did not take care,
Would come in for a share,
Which I noways intended
Till their manners were mended—
And of that there's no sign—
I do therefore enjoin,
And strictly command,
As witness my hand,
That nought I have got
Be brought to hotch-pot;
And I give and devise
Much as in me lies
To the son of my mother,
My own dear brother,
To have and to hold
All my silver and gold,
As the affectionate pledges
Of his brother, JOHN HEDGES.

WONDERFUL NATURAL PROVISION.

IN the struggle for life which is going on perpetually throughout the whole of the animal creation, it is interesting to observe the wonderful provisions which Nature makes for the preservation of the weaker and more helpless animals. In many cases the colour of the creature is adapted in a wonderful way to its mode of living and place of concealment, and contributes very materially to its safety. We know how difficult it is to distinguish the grasshopper from the leaf or blade where he is resting, till he betrays himself by moving. The birds that sing in the hedge-rows have feathers on their backs which harmonise with the colour of the leaves about which they flit, while the feathers on their breasts borrow the white hue of the clouds above them. The partridge can hardly be distinguished from the stubble where it makes its nest, while in northern countries, the winter dress of the hare and ptarmigan is white, like the snow among which they are seen. The same is the case with the inhabitants of the water. The frogs which live in the pools and muddy ditches are known to vary their colour according to the nature of the sand or mud among which they live. The tree-frog, on the other hand, is green, and thus is with difficulty distinguished from the trees to which it adheres. Fish, especially those which inhabit fresh water, are so like in colour to the weeds and stones among which they lie, that it is often very difficult to detect their presence.

One of the most wonderful instances of nature's care in providing for the protection of the more defenceless creatures is found in the apparatus for defence with which the cuttle-fish is furnished. As soon as its quick eyes catch a glimpse of an approaching enemy, knowing the impossibility of saving itself by flight, it prepares at once to seek safety in concealment. With this object, it sinks downwards, and throws out from a vessel with which it is provided a black stream of inky fluid. This entirely surrounds and conceals it, and as it takes a considerable time to disperse, the enemy is generally baffled; if, however, the cuttle-fish is still in danger, it pours out another flood of ink, and remains quiet until the peril is past.

THE FEMALE PIRATES. (FROM AN OLD PRINT.)

THE FEMALE PIRATES.

THE number of pirates who infested the Spanish Main in the early part of last century was so large that it can hardly appear wonderful that two women should be found among them, of the same lawless and daring character. Yet the story of the two female pirates—Mary Read, and Anne Bonny, is sufficiently remarkable to claim a place in our pages, and especially as we are able to give portraits of them, copied from an engraving published at the time they lived—viz., about one hundred and fifty years ago.

Mary Read was born in England. Her mother, who was married to a sailor, gave birth to a son soon after her husband had departed on a voyage, from which he never returned. When the child was about a year old, his mother left her husband's relations, and went to reside for a time with her own friends. The boy soon afterwards died, but his mother finding herself in need of assistance, took a little girl, the heroine of our story, dressed her up in boy's clothes, and passed her off on her husband's mother as her son. The deception was successful, and the widow was assisted with a weekly allowance, to ensure the continuance of which it was necessary that the girl, whose name was Mary, should pass for a boy so long as the old woman lived.

Mary was thirteen years of age when the old woman died, and being accustomed to her attire, she was not disposed to change it for the apparel proper to her sex. She first took a situation as foot-boy to wait on a French lady, then entered herself on board a man-of-war; after quitting which, she went to Flanders and carried arms in a regiment of foot as a cadet. Failing to get a commission, she changed to the cavalry, and displayed such courage as to win the esteem of her officers. Her promising career, however, was now cut short by a circumstance which has often changed the fate of men and kingdoms—she fell in love with her comrade, and having made him acquainted with the secret of her life, they pledged troth, and when the campaign was over were publicly married. Her husband, however, lived only a short time, and on his death, finding herself penniless, she resolved to resume her old manner of life; so putting on man's apparel, she went to Holland and joined a regiment of foot. But she was impatient of promotion, and finding herself one day near the coast, she seized the opportunity of embarking in a ship bound for the West Indies. It happened that this ship was taken by English pirates, who kept Mary amongst them, but soon afterwards took advantage of a Royal proclamation to surrender themselves, and live quietly ashore. This they did so long as money was plentiful; but after awhile, hearing that Captain Woods Rogers, governor of the island of Providence, was fitting out privateers to cruise against the Spaniards, Mary, with several of her

comrades, embarked for that island, resolved to make a fortune one way or other.

We now come to the most extraordinary part of Mary's story. Some of the privateer crews, who had been pardoned for piracy, rose against their commanders almost as soon as they had sailed from port, and took to their old trade. In this number was Mary Read, though she afterwards declared that she had always abhorred the life of a pirate, and had resolved to quit it whenever the opportunity should offer. If she really felt this repugnance, it was not for want of courage, as no man in the crew with which she sailed was ever more ready to seize the boarding-pike, or undertake any hazardous adventure.

Anne Bonny was born in the County Cork, where her father was an attorney. He deserted his home, and emigrated to Carolina, taking Anne with him. Here she incurred his displeasure by marrying against his will; and being turned out of doors, found her way to the island of Providence, where she made the acquaintance of a pirate captain named Rackam. On board his ship she fell in with Mary Read, who soon found it necessary to reveal to her the secret of her life. It was natural, after this, that the two women should be often together, and this intimacy excited the jealousy of Captain Rackam, who was so violent that he would have killed Mary if her secret had not been discovered to him also. They then continued their cruise in harmony, and captured a great number of ships belonging to Jamaica, and other parts of the West Indies, bound to and from England.

Between this period and the capture of the pirate ship, an incident occurred which shows in a striking manner the courage and devotion of which Mary Read was capable. Among the captives taken by the pirate captain was a gentleman of such attractive manners that Mary could not help falling in love with him. It happened that he had a quarrel with one of the crew, when the ship was lying at anchor, and a time was appointed for the two men to go ashore and fight it out. Mary would not on any account have seen the man she loved shrink from danger, yet she could hardly doubt that his chance against her shipmate would be very slight. She accordingly made an occasion for quarrelling with the pirate, some two hours before the time appointed for his duel, and fighting him with sword and pistol, left him dead.

When the pirate ship was attacked by one of His Majesty's ships, and came to close quarters, only one besides Mary Read and Anne Bonny kept the deck. So gallant was Mary, that she called down to Rackam and his crew, when they fled to the hold, to come up and fight like men; and finding no response, she fired down amongst them, killing one and wounding others. On being asked by one of Rackam's prisoners what pleasure she could have in being concerned in such enterprises, when her life was continually in danger by fire or sword, and not only so, but she must be sure of dying an ignominious death if she should be taken alive, she answered that as to hanging, she thought it no great hardship; for were it not for that, every cowardly fellow would turn pirate, and so infest the seas that men of courage must starve. Anne Bonny also showed her courage to the last. The pirate captain having been admitted to see her, by special favour, on the day he was to be executed, she told him contemptuously that "if he had fought like a man he need not have been hanged like a dog."

About their ultimate fate there is great uncertainty. They were both condemned to be hung, but Mary Read died in prison, and Anne Bonny, having been respited from time to time, also escaped execution; but what punishment she received, and what became of her afterwards, is not on record. In taking leave of them, one can but wonder and lament that qualities so admirable in all, but more particularly in a woman, as courage and endurance, should be capable of the perversion which this story illustrates.

Wonders of Vegetation.

The Floating Island on Derwentwater.—As a result of the long-continued and unprecedented drought in the lake district, that periodical phenomenon, the floating island, has again made its appearance on Derwentwater, in the neighbourhood of Lodore, its size being considerably larger than usual. For a few inches in depth it is composed of a clayey matter, apparently deposited by the water in which the growing plants have fixed their roots. The rest is a mass of decayed vegetable matter, forming a stratum of loose peat-earth about six feet in thickness, which rises from a stratum of fine soft clay. A considerable quantity of air is contained in the body of the island, and may be discharged by probing the earth with a pole. It is nearly half an acre in extent, and its appearance is indicative of an extraordinarily hot season.—*From the "Times," July 24th*, 1868.

A Green Rose.—A writer, "H. A. B.," in *Notes and Queries* some years since, made the following statement regarding a wonderful rose:—"When in Baltimore, Maryland, U.S., in the year 1852, I saw two or three young rose-trees, each bearing green roses. This was in a nursery garden. I should have procured a plant had not the gardener (who came from Scotland) assured me he had seen the same rose in the old country. As it is, I only possess a dried specimen of one of the flowers; it is a moderate-sized root, with a faint smell."

At Kingston-on-Thames, soil brought up from a depth of 360 feet, and then covered with a hand-glass, exhibited speedy vegetation.

IN the finest weather hardly a quarter of an hour passes in an American forest, when, if one listens, a tree is not heard to fall.—*Head's " Forest Scenes in North America.*

THISTLES in the Pampas are ten feet high, and clover rises four or five feet. Marigolds and camomiles in North Africa grow to four or five feet; the rhododendron grows thirty feet in India.

WONDERFUL DOGS.

"LOVE me, love my dog," says the proverb; and, indeed, there is no animal which succeeds in winning for himself the affection of man, and thus earning, as it were, a sort of claim to his individuality, so completely as the dog does. We have collected together here a few instances of that wonderful sagacity which is their most especial characteristic; some of the stories are so remarkable that we have been careful to give the sources from which they are taken.

From *Bell's Weekly Messenger* of the 23rd of October, 1803, we extract the following proof of the sagacity of the bloodhound:—"The Thrapston Association for the Prosecution of Felons in Northamptonshire have provided and trained a bloodhound for the detection of sheep-stealers. To prove the utility of the hound, the 28th ult was appointed for the purpose of exercising it. The person he was to hunt started at ten o'clock in the forenoon, in the presence of a great concourse of people, and at eleven the hound was let loose; when, after a chase of an hour and a half, notwithstanding a very indifferent scent, the hound found him secreted on a tree at the distance of fifteen miles."

A curious story of a mastiff, the comical ending of which reminds us very much of the boy in Cowper's poem, is told in the *London Magazine* for July, 1734:—"A bachelor, who lived alone in a little house about two miles from a market town, had trained up a mastiff to carry a basket to the butcher's, and return with the meat he wrote for in a piece of paper, which was placed in the basket. The dog, in passing through the village, was often attacked by the curs belonging to it. For a long time he managed to elude his assailants, and carried his meat triumphantly to his master. At length, all the dogs in the neighbourhood combined to plunder him, and on one luckless day the whole posse fell upon him. He defended his trust long and bravely, but finding at last that he was powerless against so many, he gave over fighting, and helped his assailants to demolish the spoil. He 'shared in the plunder, but (doubtless) pitied the man.'"

A Mr. Moore, of Windsor, wrote to some friends in the north of England, to obtain a well-bred greyhound, to oblige one of the keepers of Windsor Great Park, for the purpose of killing fawns in the season. The application was successful, and the greyhound was sent to London by wagon. It arrived safely in Bishopsgate Street, and from thence was conveyed to the Belle Sauvage upon Ludgate Hill, where it was delivered to the driver of a Windsor caravan, and reached the place of destination in safety. The dog was kept in-doors for two days, and paid every possible attention by the family. At the end of that time it was left free, and in less than forty-eight hours was nowhere to be found. A few days after, Mr. Moore received a letter with intelligence that the dog had reached the place of its former residence, in Yorkshire, before the return of the wagon by which he was originally sent to London.

Dr. Anderson relates the following remarkable instance of sagacity in a shepherd's dog. The owner himself, he says, had been hanged for sheep-stealing, and the following fact respecting the dog came out and was authenticated by evidence upon his trial. When the man meant to steal some sheep, he did not do it himself, but detached the dog to perform the business. With this end in view, under pretence of looking at the sheep with intent to purchase, he went through the flock with the dog at his feet, to whom he secretly gave a signal so as to let him know the individuals he wanted, to the number of perhaps twenty out of some hundreds; he would then go away, and at the distance of several miles send back the dog by himself, in the night-time. The dog would single out the sheep previously pointed out to him, and drive them home before him to his master.

Our last extract is a remarkable instance of a man's gratitude to his dog for faithful services. It is from the will of Samuel Trevithuan, of the parish of Padstow, in Cornwall, carpenter, dated Nov. 26th, 1729. The will is now in the Registry of the Consistorial Court of the Bishop of Exeter:—

"*Item.*—I do give unto my dear wife or my daughter, or to whose hands soever he may come, one shilling and sixpence weekly, for the well-treating my old dog, that has been my companion through thick and thin almost these fifteen years. The first time that ever he was observed to bark was when that great eclipse was seen, April 22nd, 1715. I say, I do give one shilling and sixpence a week, during his life, for his well-meating, fire in the winter, and fresh barley-straw now and then, to be put in his old lodging, in the middle cage, in the old kitchen, to be paid out of my chattel estate, and forty shillings a year that I reserved to make me a freeman of the county; desiring and requiring all people and persons whomsoever, not to hurt or kill him that hath been so good a servant of a dog, for sense and tractableness to admiration."

YEAST, A PLANT.

It will surprise many persons to be told that yeast is a plant. Without doubt, a very small number of those who are constantly using it for purposes of fermentation have ever looked at it in that light. To the ordinary observer it is nothing more in appearance than a thick creamy froth, which makes the bread rise and the beer work; but to the man of science, examining it with the aid of a microscope, it reveals itself as the simplest form of a large and very interesting class of plants. The yeast-plant is, in fact, a species of fungus. It is the simplest form of those growths of which moulds and mildews on the one hand, puff-balls, mushrooms, and truffles (these last being simply subterranean puff-balls) on the other, are the more suspected except by the botanist. Gardeners are aware that the productiveness of their mushroom-beds is dependent on the healthy development of a mass of "spawn," of which mushrooms are the fruit; but most persons are ignorant that the toad-stools upon rotten wood are the mere indications of an invisible but widely-spreading spawn carrying destruction in the form of dry-rot as it extends itself among the fibres of the wood. Again, the appearance of moulds or mildews upon preserved vegetable substances or liquids is an indication that the mischief is far advanced; for these are but the fruits of the fungus, which it only bears when arrived at maturity.

It seems to be an established law of nature that the weakest should go to the wall, and thus we find that mould always attacks plants of a weak and

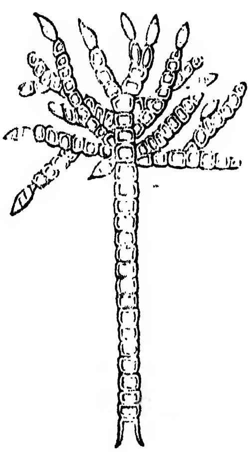


Fig. 1.

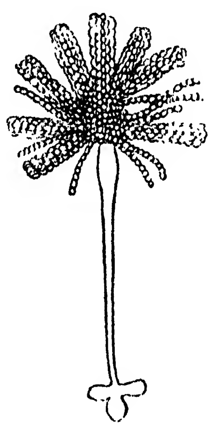
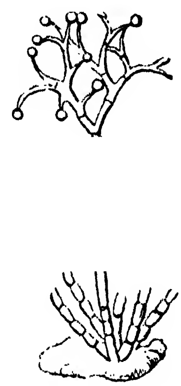


Fig. 2.



highly organised kinds. Yeast, and the vinegar plant or "mother" as it is sometimes called, are the forms in which it vegetates under various circumstances when well supplied with food. Mildew is its fruit, formed on the surfaces exposed to the air at certain periods, like the flowers and seeds of the higher plants, to enable it to diffuse itself throughout nature. The seeds, or spores as they are called, from which all these plants are developed, are so minute that they are constantly wafted about by every current of air, and deposited in every spot of earth where they can find a resting-place. When once rooted their powers of growth are so rapid, that acres of land have been known to be covered over by them in a single night. They are extremely tenacious of life, and exhibit considerable powers of resisting frost as well as extreme heat; the experiment having been tried of subjecting some of them to the heat of boiling water without in the least impairing their powers of germination.

It is frequently the case that these plants are even well developed when their presence is hardly unhealthy nature in preference to others, just as animals in a sickly state are often attacked by parasites, from which when in health they are free. In the same way deep-coloured roses are more liable to mildew than those of a more subdued tint; the colour in this case being a sign of constitutional weakness, indicating as it does a want of power to decompose carbonic acid, one of the most indispensable of vital functions in the vegetable kingdom.

The illustration gives an idea of the beautiful appearance and diversity of form assumed by some of the most minute kinds of fungus or mould found growing on our common articles of food, or vegetable substances in general, when viewed through a microscope. Fig. 1 represents the mildew found growing on the stem of a plant. Fig. 2 is the mould found growing on cheese, bread, &c. Fig. 3 is the mould usually found on decaying vegetable substances. This last is the fungus which produced such wide-spread destruction among our potato crops some few years ago.

THE MAN WITH THE IRON MASK.

THE man with the iron mask! Yes, there was such a man, who endured not for a month or so, not for a few years only, but for forty-two years, a close imprisonment, during the whole of which time he wore, without once removing it, an iron mask that effectually disguised his identity. It was never known who he was, nor did any grave suspicion rest upon any one as being the man. Not the slightest clue has ever been obtained as to the history of the mysterious stranger. The closest scrutiny has been baffled, the most diligent search foiled, in the attempt to fathom the most singular historical mystery that has ever presented itself.

Cardinal Mazarin, who had followed out Richelieu's policy, though by different means, died in 1661. Several months after his death there was sent to the Isle Sainte Marguerite, in the Mediterranean, off the coast of Provence, an unknown prisoner. This prisoner was young, in stature above the average height, and of a handsome, noble figure. On the journey he wore a mask of iron, the lower part of which was furnished with steel springs that allowed of his eating without ever taking off his mask. The orders to his guard were to kill him if he made known who he was. He remained at the island for twenty-nine years, a close prisoner, and was then removed secretly to the Bastile in Paris.

Though secluded so carefully, and guarded so specially, it was clear to all who came in contact with him that he was a person of very great importance. His rooms were handsomely furnished, he was served with the greatest respect possible, the governor of the castle himself waited upon him at meals, and never sat down without permission in his presence. His taste for elegant furnishings to his table, for fine linen and lace, was gratified to the utmost, and every facility was given him to make his rigorous confinement as light as possible. He amused himself frequently with a guitar. To give some idea of the importance of the prisoner, it may be said that the Marquis of Louvois, Louis the Fourteenth's prime minister, waited upon him before his removal from the Isle Sainte Marguerite to the Bastile, and at all the interviews he had with him never once sat down.

THE MAN WITH THE IRON MASK.

Shortly after he was brought to the isle he scratched some words with a knife on a silver plate, and flung the plate out of his prison window to a spot where he saw a fisherman's boat moored to the bank near the foot of his prison tower. The fisherman took up the plate and carried it to the governor of the castle. The governor, greatly astonished and much concerned, inquired if the man had read the writing, and whether any one but himself had seen it. The fisherman declared he could not read, and that no one else had seen the plate, which he had only just found. It was not until the governor had satisfied himself beyond a doubt that these were facts, that he let the man go, saying, as he released him, "It is well for you that you do not know how to read."

A doctor who attended the man with the iron mask during his incarceration in the Bastile, said

that though he had long waited upon him, he had never seen his face, but his tongue and all the rest of his body he had seen, and that he was admirably formed. Never did this man complain of his condition; never did he let fall a word by which it might be known who he was.

M. de Chamillart, Minister of State, was the last minister who possessed a knowledge of this mystery. When he was dying, his son-in-law, the Maréchal de la Feuillade, begged him on his knees to tell him who "the Man" was. The dying minister refused, saying it was a state secret, which he had sworn never to reveal.

In 1703 "the Man in the iron mask" died, having spent forty-two years of his life in prison. He was buried at night, still disguised in his mask, and there was no one to say who or what he had been. At the time of his first imprisonment there was not missed from Europe any one of note, such as "the Man" would seem to have been, nor has any clue been found, either directly or indirectly, to the history of this remarkable being. Suggestions there have been in plenty, but all wide of the mark. The secret of Mazarin's—if Mazarin's it was—has hitherto been shrouded in an impenetrable veil, which all the ingenuity of historians and biographers has been unable to lift. Who shall solve the mystery? A century and a half have rolled away since the great liberator, Death, freed the captive from his prison, and no voice has been found to declare either his name or his generation. Should time eventually reveal them, it must still remain a wonder of the world that ever there should have been a prisoner who was a party, as it were, to his own captivity; who never complained of the treatment which he received at his gaoler's hands; never was known to murmur at his mysterious lot; never, except in the case of the plate, tried to reveal himself; never attempted to escape; was kind and gentle to all who approached him, and whose imprisonment was yet so rigorous as not only to seclude him wholly from the outer world, but to require as one of the conditions of the prisoner's existence, that he should live and die an unknown man, hidden from the sight of his fellow-creatures by the hideous device of an iron mask.

WONDERS OF DREAMLAND.

Many are the wonders of dreamland, of which we can here only record a few remarkable examples. In a large class of dreams it is certain that the persons or things seen have been previously well known to the dreamer, but, perhaps, not lately thought of. If, according to the philosophy generally received, such appearances are nothing but the recollected images of the persons or objects seen, they are still wonderful. A beloved and long-lost friend suddenly appears in a dream, so like the waking reality that it is impossible to distinguish between the sensations caused by them respectively. This being so, we may well speak of such things as "wonders," be the explanation of them what it may.

Abercrombie treats of dreams as hallucinations, and in support of his opinion relates the following:—"An eminent medical friend having sat up late one evening, under considerable anxiety about one of his children who was ill, fell asleep in his chair, and had a frightful dream, in which the prominent figure was an immense baboon. He awoke with the fright, got up instantly, and walked to a table which was in the middle of the room. He was then quite awake, and quite conscious of the articles around him; but close by the wall, at the end of the apartment, he distinctly saw the baboon making the same grimaces which he had seen in his dream. The spectre continued visible for about half a minute."

If the dreamer, in this instance, had ever seen a baboon making similar grimaces, the spectre would justly be called a recollected image; but it is still wonderful that such an image should suddenly start into existence, like the living thing itself. If he had never seen a baboon under similar conditions, but only a picture of one, it is still more wonderful that the picture, after having been forgotten perhaps for years, should in an instant assume the form and substance of a living creature, and in all respects act as if alive. Look at such phenomena as we will, they are, to say the least, marvellous. To assume that they can easily be explained by the association of ideas, is only to urge one mystery in explanation of another.

A second wonder of dreamland is that of the transformation or substitution of one set of ideas for another; but in such a way, that the new images are the actual product of the old. One night, for example, the writer dreamed that he was walking by the side of a river, and saw a fair young girl taken out of the water and laid upon the bank. She was dead, but her beautiful blue eyes were wide open, and were fixed upon him, as he thought, with a steadfast gaze. The intensity of the feeling thus excited caused him to wake, and after a few moments' reflection, he was able to trace this dream to its origin. Immediately before going to bed he had heard the mouse-trap in the pantry shut down with a click, and wishing to set it again, he had drowned the mouse in a pail of water, and had afterwards shaken it out of the trap. He remembered observing that the mouse's eyes were open as it lay dead on the table, and that they were blue. He then re-set the trap, and immediately went to bed. The dreaming sense had transformed the image of the mouse to that of a fair young girl; the pail of water had become a river, to harmonise

with the altered conditions of the little drama that was to be played over again; and two or three strange characters were introduced, in the shape of the persons who drew the girl out of the water. So far the dream is accounted for; but is it not wonderful when viewed in this light? It is as if a poet with fine dramatic instincts had taken a hint from the drowned mouse, and invested the incident with the most touching human interest. Such a transformation did not occur to the writer while he was awake. Why, or rather, by what law of intellectuality did it occur to him when asleep?

The *time* occupied by a dream is another marvel of dreamland. We read in "The Philosophy of Mystery" that a gentleman dreamed he had enlisted as a soldier, that he had joined his regiment, that he had deserted, was apprehended, and carried back to his regiment; that he was tried by court-martial, condemned to be shot, and was led out for execution. At the moment of the completion of these ceremonies, the guns of the platoon were fired, and at the report he awoke. It was clear that a loud noise in the adjoining room had both produced the dream and awakened the dreamer almost at the same moment.

"There was another gentleman," says Mr. Dendy, "who, for some time after sleeping in the damp, suffered a sense of suffocation when slumbering in a recumbent position; and a dream would then come over him as of a skeleton which grasped him firmly by the throat. This dream became at length so distressing, that sleep was to him no blessing, but a state of torture; and he had a servant posted by his couch to awake him at the very instant he fell asleep. One night, before being awakened, the skeleton made his attack, and a long and severe conflict ensued. When fully awake, the dreamer remonstrated with the watcher for having allowed him to remain *so long* in his dream, and, to his astonishment, learned that his dream had been *momentary*. He was roused at the instant he began to slumber."

A very remarkable instance of the kind is related by the famous Count Lavalette. It occurred while he was confined in a French prison. "One night, while I was asleep," he says, "the clock of the Palais de Justice struck twelve, and awoke me. I heard the gate open to relieve the sentry, but I fell asleep almost immediately. In this sleep I dreamed that I was standing in the Rue St. Honoré, at the corner of the Rue de l'Echelle. A melancholy darkness spread around me; all was still. Nevertheless, a low and uncertain sound soon arose. All of a sudden I perceived at the bottom of the street, and advancing towards me, a troop of cavalry; the men and horses, however, *all flayed*. The men held torches in their hands, the flames of which illumined faces without skin, and with bloody streaks. Their hollow eyes rolled fearfully in their large sockets, their mouths opened from ear to ear, and helmets of hanging flesh covered their hideous heads. The horses dragged along their own skins in the kennels, which overflowed with blood on both sides. Pale and dishevelled women appeared and disappeared alternately at the windows in dismal silence; low, inarticulate groans filled the air, and I remained in the street alone, petrified with horror, and deprived of strength sufficient to seek my safety by flight. This horrible troop continued passing in rapid gallop, and casting frightful looks on me. Their march, I thought, *continued for five hours*, and they were followed by an immense number of artillery wagons, full of bleeding corpses, whose limbs still quivered. A disgusting smell of blood and bitumen almost choked me. At length the iron gate of the prison shutting with great force awoke me again. I made my repeater strike. It was no more than midnight, so that the horrible phantasmagoria had lasted *no more than ten minutes*—that is to say, the time necessary for relieving the sentry and shutting the gate. The cold was severe, and the watchword short. The next day the turnkey confirmed my calculations. I, nevertheless, do not remember one single event in my life the duration of which I have been able more exactly to calculate than the time apparently occupied in the dream."

These are only some of the wonders of dreamland. There is so much to relate of a similar kind, or more marvellous still, that we must return to the subject at another opportunity.

Wonderful Showers.

A SHOWER OF FISHES.—In 1833, at Lake Gwynant, in the county of Caernarvon, a woman was engaged washing a pail at the edge of the lake, and a number of children were with her. While she was thus employed, at eight p.m., a shower of small fishes fell partly into the lake, partly upon the land, close to where the woman was. The fish resembled herrings, but were much smaller. A heavy shower of rain had preceded the descent of these fishes, and the day following there was much rain and thunder.—*Caernarvon Herald*, 1833.

A SHOWER OF CRABS.—Lord Eastnor, of Tyttenhanger Park, Kent, writes, in August, 1836:—"Soon after a most violent storm of rain and wind, in the summer of 1829, three small crabs, weighing from 1¼ to 1¾ oz., were found in the area of the workhouse at Reigate; and a fourth was afterwards found at a little distance, I think the following morning. One of them appeared to be still living. In the morning of the day previous to the storm the area of the workhouse had been thoroughly

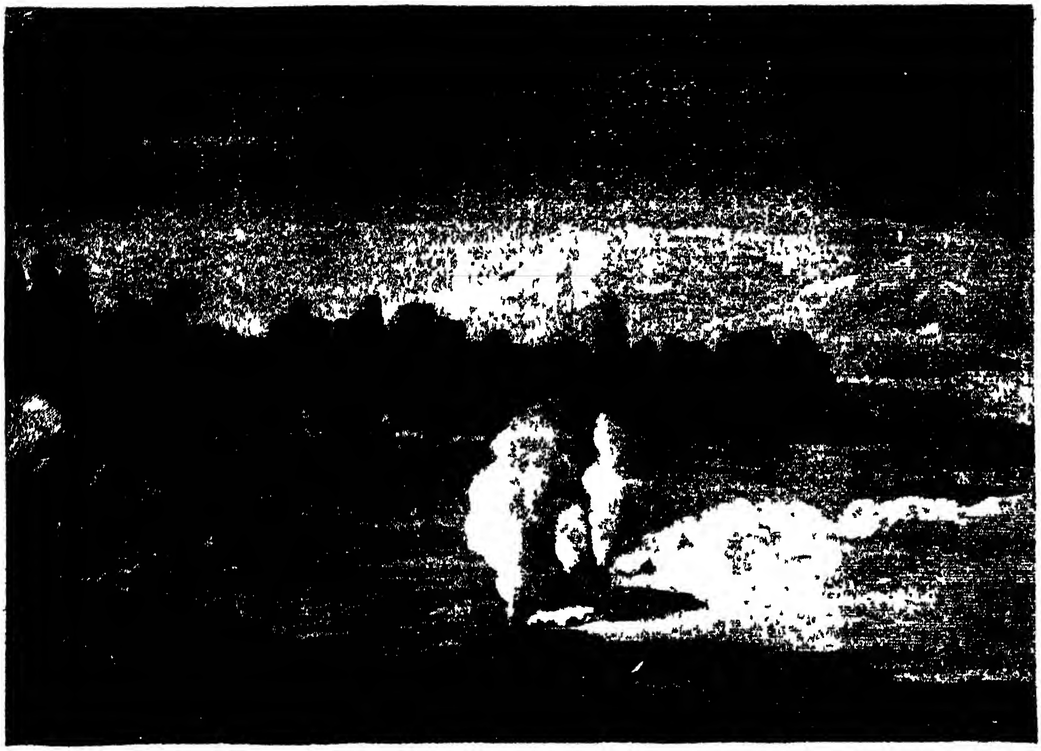


Fig. 1.—THE PLAIN OF LAUGARVATN—GENERAL VIEW.

swept and cleaned; consequently they must have been seen had they been there then. They were found by a boy, who told the governor that he had found a comical sort of a frog."

Fall of Fishes.—Yesterday morning a great number of small fish were found swimming in the gutters in Jefferson Street. During the night previous a heavy rain fell, and the fish of course descended with the water. We saw a number of them; they were from two to three inches long, and were mostly sun-perch.—*Louisville Newspaper*, Nov., 1835.

Shower of Young Herrings.—On the 9th March, 1830, the inhabitants of the island of Isla, Argyleshire, after a day of heavy rain, were surprised to find numbers of small herrings strewed over their fields, perfectly fresh, and some of them exhibiting signs of life. Similar instances of showers of small fish are well authenticated.—*Note by Yarrell in Reid's "Law of Storms."*

Fall of Fish in Kent.—About Easter, in the year 1666, in a pasture-field in the parish of Stansted, which is a considerable distance from the sea or any branch of it, and a place where there are no fish-ponds, there were found fish in quantity about a bushel, supposed to have been rained down from a cloud, there having been at that time a great tempest of thunder, hail, wind, &c. These fish were about the size of a man's little finger; some were small whitings, others like sprats, and some rather like smelts. Several of these fish were shown publicly at Maidstone and Dartford.—*Hasted's "History of Kent."*

GEYSERS.

The Geyser, or as we, using the kindred English word, should say, "gusher," is a phenomenon peculiar to the small island of Iceland—a strange, wild plateau of land heaved up from the bottom of the Atlantic, on the confines of the Arctic Ocean, as if to show what Nature *can* do when she has a mind to it, in the way of making extremes meet. Some of its mountains are volcanic, pouring out their lava flood into the valleys beneath; others are crowned with eternal snows and glittering with glaciers. Cold streams ripple on among the scoriæ beds on the level lands, while not far away, boiling hot springs, or geysers, bubble up from the sub-soil or fling their spray to the clouds.

The most remarkable group of geysers is that on the plain of Laugarvatn, represented in Fig. 1. Over an area of about a square half mile, on the slope

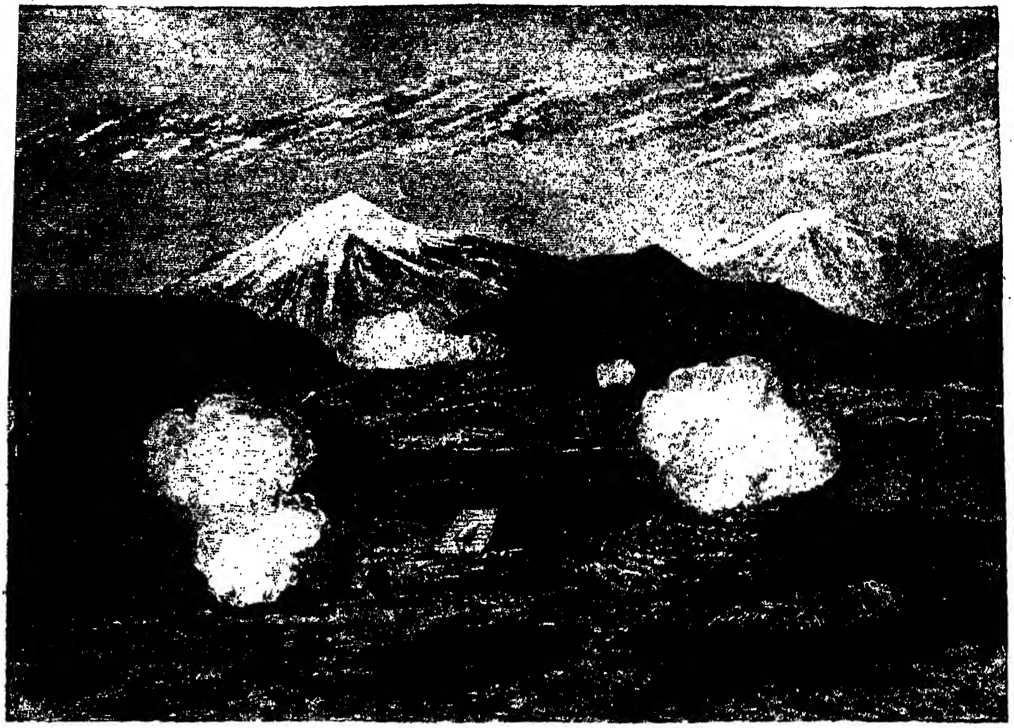


Fig. 2.—THE PLAIN OF LAUGARVATN—THE GREAT GEYSER.

of a slight eminence rising from the valley of the White River, are scattered some scores of boiling springs—the basins of two or three of them measuring several yards across, while the majority range from the size of a tea-cup to that of a good sized cauldron—all of them bubbling and throwing off steam, a few sending a column or jet of hot water straight up into the air. Around the mouth of each is a small rim or incrustation, formed of the sand, which is thrown up by the water during its bubblings. Besides those constantly in the boiling state are a few that are spent, and some that are only in a state of eruption at intervals. The two largest and most interesting of those that are constantly in the boiling state are the Great Geyser, or "gusher," and the Strokr, or "churn."

The Great Geyser (Fig. 2) lies on the summit of a sandy rim, or mound, of its own formation, rising about fifteen feet above the level of the plain. The pool is circular, and measures something like twenty-four feet across. Its depth ranges between four and five feet, except in the centre, where a sort of shaft, also circular and a little over two yards in diameter, dips to a depth of eighty-three feet. It is up this shaft that the boiling water rises continuously from the bowels of the earth. During the greater part of the day the flow is very small, and trickles in a tiny stream down into the plain, through a channel which it has worn in the mound. At intervals of five or six hours, the water boils tumultuously, and sends up little jets a few feet above the surface; and once in the twenty-four hours this boiling culminates in a grand eruption, during which columns of water are repeatedly flung to a height of seventy or eighty feet, and give off a mass of steam, which obscures the country for a mile round. The heat of the water at the bottom of the shaft, just before one of these great eruptions, has been found to be as much as 261° Fahr., which is considerably over the boiling point. At the side of the pool on the summit of the mound, the temperature of the water is about 190° Fahr. In the centre, it is much higher, ranging from 220° to 230° Fahr.

The Strokr is a much smaller geyser, and does not "play" unless forced to do so. It is an irregular-shaped hole some six or eight feet in diameter. The depth of it is unknown, for its course is crooked and cannot be measured. The boiling water lies some twenty feet down, where it may be seen bubbling and throwing up steam all day long. At the bottom of the pool is a narrower aperture; and if enough turf can be thrown in to stop it up, the result is of a most magnificent description. First

there is a great rumbling noise; then an explosion is heard below, followed by the flinging up of an immense body of water, which rises to a height of sixty feet, and breaks into showers of spray, which seem to fall from clouds of steam.

It is now the generally received opinion that these eruptions are produced by the incredibly rapid production of vapour in the bowels of the earth, which takes place when the water from which it is obtained has been boiled over and over again. The manner in which it is supposed to operate is shown in the small engraving given below. The water, it will be seen, fills A, the cavernous

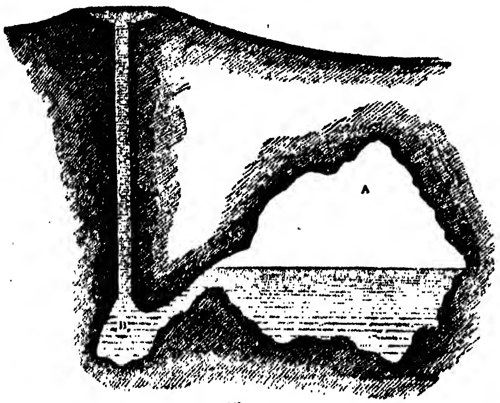


Fig. 3.

reservoir under ground, to a point higher than its outlet, B; and when enough steam is generated to fill the remaining space, the water is of course forced out more rapidly. Periodically the steam rises to its highest point, and then we have the magnificent eruptions which, consisting both of steam and water, may be supposed to clear out the cavern down to the level of the outlet. The water, it is thought, is heated by the same subterranean fires which pour from Mount Hecla, which latter is situated within a few miles of the Geyser group of Laugarvatn.

Sagacity of Animals.

WAR HORSES.—When horses are hit in battle, they stop, tremble in every muscle, and groan deeply, while their eyes show wild astonishment. During the battle of Waterloo, some of the horses, as they lay on the ground, having recovered from the first agony of their wounds, fell to eating the grass about them; thus surrounding themselves with a circle of bare ground, the limited extent of which showed their weakness. Others of these interesting animals were observed quietly grazing in the middle of the field, between the two hostile lines, their riders having been shot off their backs; while the balls that flew over their and the tumult behind, and before, and around them, caused no interruption to the usual instincts of their nature. It was also observed that when a charge of cavalry went past, near to any of the stray horses already mentioned, they would set off, form themselves in the rear of their mounted companions, and though without riders, gallop strenuously along with the rest, not stopping or flinching when the fatal shock with the enemy took place. At the battle of the Kirk, in 1745, Major Macdonald, having unhorsed an English officer, took possession of his horse, which was very beautiful, and immediately mounted it. When the English cavalry fled, the horse ran away with its captor, notwithstanding all his efforts to restrain him; nor did it stop until it was at the head of the regiment, of which, apparently, its master was the commander. The melancholy and, at the same time, ludicrous figure which Macdonald presented when he thus saw himself the victim of his ambition to possess a fine horse, which ultimately cost him his life upon the scaffold, may be easily conceived.

AN INTELLIGENT DOG.—Dr. Williams did show me how a dog that he hath do kill all the cats that come thither to kill his pigeons, and do afterwards bury them; and do it with so much care that they shall be quite covered. That if the tip of the tail hangs out, he will take up the cat again, and dig the hole deeper, which is very strange; and he tells me that he do believe that he hath killed above 100 cats.—*Pepys*, vol. i., p. 219.

WONDERFUL CATS.—It is on record that a shoemaker in Edinburgh chanced to leave the door of a lark's cage open, of which the bird took advantage to fly away. About an hour afterwards, a cat belonging to the same person, made its appearance with the lark in its mouth, which it held by the wings over the back in such a manner that the bird had not received the least injury. After dropping the bird on the floor, the cat mewed, and looked up to her master as if expecting his recognition of her cleverness. The writer has himself observed many instances of a remarkable instinct in cats, and at the present time has one which every day knocks at the door—sometimes modestly, sometimes with a sharp double knock like a postman, occasionally with a series of raps, pianissimo, like a lady or a quiet single gentleman. The door is half glass, and the knocker low. The cat was not taught, but acquired the trick by his own observation.

LUMINOUS VEGETATION.

MR. GARDNER, in his "Travels in Brazil," relates the following:—"One dark night, about the beginning of December, while passing along the streets of the Villa de Natividade, I observed some boys amusing themselves with some luminous object, which I at first supposed to be a kind of large fire-fly; but on making inquiry, I found it to be a

beautiful phosphorescent fungus, and was told that it grew abundantly in the neighbourhood on the decaying leaves of a dwarf palm. Next day I obtained a great many specimens, and found them to vary from one to two and a half inches across. The whole plant gives out at night a bright phosphorescent light, of a pale greenish hue, similar to that emitted by the larger fire-flies. From this circumstance, and from growing on a palm, it is called by the inhabitants 'Flor do Coco.' The light given out by a few of these fungi in a dark room was sufficient to read by. I was not aware at the time I discovered this fungus that any other species of the same genus exhibited a similar phenomenon; such, however, is the case; and Mr. Drummond, of Swan River Colony, in Australia, has given an account of a very large phosphorescent species occasionally found there." This property is also possessed by some of the mosses in this country. In searching for ferns and other botanical specimens, the writer has often found moss shining with great brilliancy in the furthest recesses of a dark cleft in a rock, though on being brought out to the light, it did not present an appearance in any way remarkable.

WONDERS OF SYMPATHY AND ANTIPATHY.

It is well known that certain objects excite an instant horror in the minds of persons to whom they are antipathetic, and this in a manner quite distinct from the affectation of fright. There are silly girls who are ready to shriek at the sight of a spider; but though, in many cases, this may be the result of what is commonly called nervousness, and in rare instances may be the sign of a real antipathy, it is more often foolishness and nothing more. Some remarkable instances of real sympathy and antipathy are, however, collected by Millingen in his book on "Mind and Matter." Amatus Lusitanus relates the case of a monk who fainted when he beheld a rose, and never quitted his cell while this flower was blooming. Orfila (a less questionable authority) gives the account of the painter Vincent, who was seized with violent vertigo and swooned when there were roses in the room. Volpi relates the history of an officer who was thrown into convulsions and lost his senses, in consequence of pinks being shut up with him in his chamber. Zimmerman tells of a lady who could not endure the feeling of silk and satin, and who shuddered when touching the velvety skin of a peach. Boyle records the case of a man who felt a natural abhorrence of honey; and that of a young man who fainted when the servant swept his room. Hippocrates mentions one Nicanor, who swooned whenever he heard a flute. Boyle himself, in spite of his philosophy, fell into a syncope when he heard the splashing of water; Scaliger turned pale at the sight of watercresses; Erasmus experienced febrile symptoms when smelling fish; the Duke d'Epernay swooned on seeing a leveret, although a hare did not produce the same effect; Tycho-Brahe fainted at the sight of a fox, Henry III. of France if he saw a cat, and Marshal d'Albret if a pig faced him. Every one in the least acquainted with history is aware that King James I. could not endure a drawn sword; and the writer often feels a cold shudder thrill through him at the bare thought of a knife. Effects of this kind are in the majority of instances purely physical; in some cases, however, the imagination is first affected.

THE WONDER OF THE TELEGRAPH.

I.—RECORDING SIGNALS.

Any ordinary mechanic is aware that when a motive power is once obtained, it can be converted by mechanism to almost any use required. In our account of Electro Magnetism, it has been shown in a very simple manner that the operator has at his command a source of mechanical action, which he can use at pleasure. We have seen that the attractive power of the magnet being made to act upon the "armature" or "keeper," produces a simple up and down motion, which may be used in the simplest manner to strike a bell, as already shown, or to liberate the detents of a clock movement, and set in motion various kinds of complicated machinery. With this power at his command, it is not difficult to conceive how an ingenious mechanic may arrange for any kind of action in the machinery that may be required to effect his object. For example, A (Fig. 1) is a magnet, *b* the armature or keeper, working on a pivot *c*; *d*, the extended arm of the keeper, furnished with a point projecting against the strip of paper *e e*. The current of electricity having been turned on to the magnet A (Fig. 1), it attracts the keeper *b*, and its motion causes the point at *d* to rise and make an indentation in the

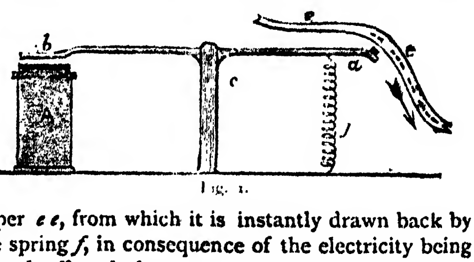


Fig. 1.

paper *e e*, from which it is instantly drawn back by the spring *f*, in consequence of the electricity being turned off, and the magnet ceasing to attract. If the paper is made to pass over a drum set in motion by the action of clockwork, and thus to move in the direction indicated by the arrow, while the point at *d* is rapidly striking against it, we shall get a row of indentations. If contact be made, three times, for example, in quick succession, there will be three impressions close together, and

a pause in working the current while the clockwork continues in motion will be represented by a blank on the paper. It may be agreed beforehand that three dots thus impressed shall represent the letter *a*, four *b*, and so on to the end of the alphabet.

Such a system, however, would entail an enormous waste of time and power for want of a well connected system of signs; besides which the mechanism is so rudely conceived as to be open to some practical objections. People acquainted with the delicacy of voltaic electricity itself, and with that of the machinery used in telegraphy, will be disposed to smile at this "rule of thumb" work, and at the neglect of some important conditions which it involves. Nevertheless, there is enough here to illustrate the *principle*, and the reader who has hitherto had no conception of the process will see that the wonder of the telegraph is in some measure revealing itself to him.

Instead of *dots* only, as supposed in the above illustration, Professor Morse, an American, hit upon the ingenious device of impressing *dots* and *dashes* on the telegraph paper, and thus secured the desired simplicity, speed, and certainty in the transmission of messages. The explanation of this system of telegraphy will be easy to understand by reference to the above figure. As the paper unrolls from the drum, and the electro-magnet is put into rapid action, we obtain a series of dots as already described; but it is obvious that if the lever be held down—in other words, if the magnetic current be allowed to act—while the paper unrolls over the point at *d*, an impression of a dash will be made instead of a dot; and this dash will be long or short, in proportion to the time the keeper is kept in contact with the magnet. The action of the operator is precisely like that of playing on a piano or an organ and *holding the note*, only that in the case of electricity, the action that takes place is not affected by the distance of the operator from the place where his music is heard—that is to say, where the instrument delivers the message. He touches the key a thousand miles away, and the electric current flashes through the wire, the magnet attracts the keeper, and the dot is made; he holds the key down, and the dot is converted into a dash. It is only necessary to make the various combinations of dots and dashes stand for letters, and the message can be read almost as easily as if it were in the sender's handwriting. For example:—

a	*b*	*c*	*d*	*e*	*f*	
. —	—— . . .	—— . — .	—— . .	.	. . — .	
g	*h*	*i*	*j*	*k*	*l*	*m*
— — .	. . . .	. .	. — . —	— . —	. — . .	. —
n	*o*	*p*	*q*	*r*	*s*	*t*
— .	— — —	. — — . .	— — . —	. — .	. . .	—
u	*v*	*w*	*x*	*y*	*z*	
. . —	. . . —	. — —	— . . —	— . — —	—— — . .	

With such a system of signs as this, the printing of the message is of course abbreviated. If only dots were used, for example, to telegraph "All well," one dot being for *a*, five for *e*, twelve for each of the four *l*'s, and twenty-three for *w*, there would be seventy-seven indentations, and great care in counting them would not prevent serious mistakes; whereas by the above system of dots and dashes the message is briefly expressed thus:—

l	*l*	*w*	*e*	*l*	*l*
— . .	. — . .	. — —	.	. — . .	. — .

Here another wonder of the telegraph has to be mentioned. Some of our readers may have seen these characters printed on telegraph ribbon apparently with blue ink. This is effected by combining chemical action with the marking apparatus, and is the invention, we believe, of Mr. Bain, who saturates the slip of paper in a solution of cyanide of potassium. The

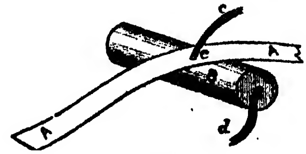


Fig. 2.

ribbon so prepared (A A in the diagram, Fig. 2) is passed over a brass drum B, upon which it is pressed down by the iron point C C, when contact is made by the sender of the message. The electric current, passing from the point C through the paper saturated with cyanide of potassium, causes decomposition to take place, and thus a small quantity of cyanide of potassium is found everywhere the point touches the paper. This cyanide of potassium is, in reality, Prussian blue, and thus it is the dots and dashes take that colour. The electric current passes out of the machine by the spring *d*.

The above system of telegraphy, whether by indentations impressed on the paper, or by colouring matter, or however the code of signs may be varied, is "Morse's system." Some years ago an improvement was made by Mr. Bain, which consisted in *preparing* the message by means of a separate instrument, the action of which is purely mechanical. The prepared message appears in the form of apertures punched on a strip of paper, and this strip of paper, being passed through a transmitting machine, makes or breaks the voltaic circuit by means of a delicate spring, which passes through the holes, and touches the periphery of a metal wheel. This invention has been further perfected by Mr. Allan, whose arrangements for preparing the message, including an important improvement on Morse's code of signals, seems to approach as near perfection as possible with our present knowledge.

Having endeavoured in this article to make the unscientific reader acquainted, as far as possible, with the recording system of telegraphy, we propose in our next article to describe the needle invented by Messrs. Cooke and Wheatstone.

Wonders of the Ocean.

SEA-NETTLES.

In the neighbourhood of the Azores may be seen, a little to the southward of the group, one of the most wonderfully beautiful sights the ocean has to show. The water, especially in calm weather, is literally crowded with creatures, small in size and fantastic in shape, and painted in all the colours of the rainbow. These are sea-nettles; living organisms of a low order, but marvellously ornate and beautiful. Count them you cannot. Myriads upon myriads throng the water, swimming layer upon layer, and, according to their specific gravity, high or low in their watery domain. Here is a dark brown patch of jelly, some six inches in diameter, looking not unlike the leather suckers with which boys play at air-pump, only it is marked around its centre with gorgeous coloured eyes, and has an elaborate fringe of colour round its outer circumference. It throbs along in the water, jostling a shoal of tiny, half-egg shaped transparent things, with pink and blue lines upon an azure ground, and having long threads or feelers, which twist about continually, pendant from the inner central spot. In solitary state goes a half transparent bell, five inches in diameter, of a very pale blue colour, stamped on its top surface with a bright purple cross, between each arm of which is a dark, purple-coloured mark, something like a horse-shoe. Over the sides of the bell run, from the centre towards the circumference, delicate lines of light purple, which pick out the form of the creature as decorators mark the lines in architecture with threads of colour. A short stem, like a handle to this incomparable umbrella, points downwards in the water, and from the lower end of it hang long white threads, which wave about as if in search of food. Then there are mushroom-shaped things, about mushroom size, but marked on their heads like strawberries. There are acorn-like objects of all sizes and colours, and gelatinous discs, marked with coloured spots, and devoid of hanging threads, which move along with a palpitating motion, their cups being sometimes turned up and sometimes down. Some are transparent jellies, not so globular in form as the rest, having an opaque white cross let in like a crest upon the top surface, with a handsome black spot of exceeding brilliance stamped on each of the four angles. The outer edge of the circle has a yellow tinge, and from the edge itself hang down innumerable threads of a pink colour, which stream away in the water as the creature is swept onwards.

SEA-NETTLES.

It would be endless to describe all the classes of this convoy, the members of which no man can number. They seem to be an agglomeration of nerves, for though they swim so near the surface, and are apparently so thoroughly within reach, it will be found the most difficult matter to haul them in with a bucket. Perseverance, however, will be rewarded, the shyness of the coy creatures will be overcome, and then the pursuer of knowledge will find, if he

puts his hand into the pail, why these delicate creatures are called sea-nettles. From the threads of which mention has been made, will be discharged a nervous fluid, which imparts a stinging sensation to the skin, and in some cases causes complete numbness of the hand. Irritation, however, of the creature's nerves by means of a piece of stick will discharge all the fluid, and then they may be handled with impunity, and their simple beauty may be admired in peace.

These creatures are to be found all over the warm regions of the ocean, especially within the tropics; but the place where they abound is at that spot near the Azores where the Gulf Stream begins to lose its force. There they are massed in vast multitudes, because of the ever-decreasing temperature of the warm water in which alone they can live; and their area is circumscribed by the unfriendly volumes of cold water which shut them in on every side.

And the function of these creatures?—is to supply food to the whale, whose small swallow, for all that he is himself so large, cannot accommodate anything bigger or less pulpy and soft than the beautiful, delicate bodies of the sea-nettles.

Wonderful Mechanical Contrivances.

AN entry in Evelyn's diary of February 24th, 1655, gives an account of a curious mechanical contrivance which the writer had lately seen. This was a table-clock, whose balance was only a crystal ball sliding on parallel irons, without being at all fixed, but rolling from stage to stage till it was thrown up to the utmost channel again, made with an imperceptible declivity; thus, by a continual vicissitude of motion, entertaining the eye every half-minute, and the next half giving progress to the hand that showed the hour, and giving notice by a small bell, so that in one hundred and twenty half-minutes, or periods of the balls falling on the spring, the clock part struck. The clock was richly ornamented, and had been presented by a German prince to King Charles I.

ABOUT twenty years ago, an Hungarian, M. Kempelon, exhibited at the Egyptian Hall a speaking machine which he had invented, and had expended the greater part of a long life in constructing. Externally, it presented the effigy of a human face and figure, while its internal anatomy consisted of a reed or glottis, of air-chest with valves, bellows for lungs, a mouth and jaws, and nostrils. It pronounced most letters perfectly, but *d*, *k*, *g*, and *t* imperfectly. The voice or tone was somewhat harsh, but it uttered long words and sentences with great facility, and they were perfectly intelligible. The inventor, a venerable-looking man of over eighty, produced the tones by operating on a keyboard like that of a pianoforte; he had, unfortunately, suffered much from rheumatic gout in the joints of the hands, so that his manual power was of the feeblest and most bungling kind, but notwithstanding, the effects he produced were most startling.

THE BLACK DEATH.

WONDERFUL in its origin, in its characteristics, in its consequences, was the great pestilence known as the Black Death, which swept half the people out of England in 1348. For two years previously there had been gradually spreading over the eastern parts of Europe a virulent disease, imported from Asia, which had made havoc of the people in some of the finest portions of the world. So dreadful indeed had been its ravages that, according to the most respectable monkish writer of the time, many Saracens, convinced that the pestilence was a sign of God's wrath on account of their unbelief, became Christians, till, finding the Christians to be likewise afflicted, they returned to their old faith. A series of earthquakes, which shook the whole of eastern Europe, ushered in the year 1348; men's hearts quailed for fear, and many were the steps taken—short of draining the towns and providing better ventilation—with the view of propitiating the Divine wrath. In vain. The plague which had scourged Asia and the Greek empire crept slowly but surely westward, seemingly uninfluenced by the coldness of climate, or by the intervention of sea. Boccaccio has written in the preface to his "Decameron" an account of the plague as it operated in Florence, which no one who has ever read it can forget. Within a few months of its slaughter of the Florentines, it had swept through Spain, France, and Germany, and had crossed the Straits of Dover.

From June to December, 1348, there had fallen in England an almost incessant downpour of rain; the ground was damp, and the streams became polluted by the surface-drainage which was washed like compost all over the country, in default of a proper outlet into a proper receptacle. In August the first cases were reported; by November the capital was reached, and from London the plague spread all over the kingdom, and, says Stowe, "so wasted and spoyled the people, that scarce the tenth person of all sorts was left alive." This was not an exaggeration of what happened in some places; "there died an innumerable sort, for no man but God only knew how many." Between the 1st of January and 1st of July, 1349, there died in the city of Norwich 57,104 persons; Yarmouth buried 7,052 in the year; and other towns in the eastern counties suffered nearly as much. In the thirteen acres of Spittle Croft (the site of the existing Charterhouse), which was given by Sir Walter Manny for the burial of the dead because the London churchyards were choke full, were buried fifty thousand persons. The plague was swift in execution; those seized by it often dying

within six hours, and none lasting over three days. The ties of nature seemed loosened; parents forsook their children, the dead remained in many instances without burial, and were allowed to take their revenge on the living by adding fearfully to the pestilential character of the atmosphere. Cattle became infected with the disease, and their bodies lay rotting in the fields untouched by the birds of prey. How many of the people died it is not possible to say with certainty; but the most reliable accounts state that, taking England all through, half of the entire population died. The eastern counties never recovered from the ravages of the plague; places which awhile had been the seats of manufacture became obscure villages, and to this day there may be seen in those counties, places in which large churches that once were too small for the congregation, have survived only to attest what the villages they preside over once were.

Half the population! The labours of agriculture were neglected; the courts of justice were not opened; Parliament was prorogued from time to time; the whole business of the country drifted for very lack of hands to attend to it, and the curse of the plague became so notorious that the Scots swore by it, by the "foul deth of the English." For a time Scotland escaped, and the Scots, taking advantage of the weakened condition of their southern foe, collected an army for the purpose of finishing what the plague had spared to do. But into their camp at Selkirk the "foul deth" came and slew five thousand men, and put an end to the project of invasion.

All sorts of reasons were assigned for the visitation. Some declared it was a sign of God's anger at the extravagance and effeminacy of the men; others that it was because of his wrath at the gay costume of the women, who seemed to have arrayed themselves more after the fashion adopted by some women now-a-days, than after the fashion either of Solomon or the lily of the field. Some said one thing and some another, but we do not hear of any one hitting the real blot, and assigning the cause to the anger of God against filthy streets, unwholesome houses, undrained towns, and utter want of ventilation. The Black Death was a wonder in its effects rather than in its causes, and was attended by the supplementary wonder, that it went away without a Great Fire, which, by burning down the plague-cherishing towns, might have prevented, as it did later on in London, a recurrence of the visitation. At intervals afterwards, the plague returned, though never again with such destructive power; it came, and went, and devoured its victims, till people found out what it was that God was angry about. Then it went away finally, leaving behind it a promise to return—a promise which holds good at the present hour—whenever men should so tempt their fate as to provoke it by dirt and those other abominations upon which it thrives.

Wonderful Precocity of Musicians.

MOZART, like many other musicians, at a very early age gave indications of extraordinary musical genius. When he was only three years old he was observed to take a wonderful interest in the lessons on the harpsichord his sister was taking from their father, and was soon able to play several airs, which he learnt with great facility. When he was five years old he had already composed some small pieces, and at the age of six he wrote a concerto for the harpsichord. In 1763, when he was seven years of age, he appeared before the French court at Versailles, and in the same year he performed in Paris at two public concerts. The Baron Grimm, the well-known musical critic, speaks thus of his arrival in Paris:—"A chapel-master from Salzburg, named Mozart, has just arrived here with two charming children. His daughter, who is eleven years old, performs the most brilliant music on the harpsichord with surprising precision. Her brother is so wonderful a prodigy, that one can hardly believe one's eyes and ears. Though his little hands can hardly stretch a sixth on the key-board, he will execute the most difficult passages with perfect facility. But that is nothing. What is almost incredible is the way in which he extemporises by the hour, abandoning himself to the inspiration of his genius, while a crowd of most charming ideas seem to succeed each other without anything like confusion, and in the most perfect taste." In 1764 the children were brought over to this country, and had the honour of performing before the royal family. During his visit, the young Mozart astonished the musical world of London by the composition of six sonatas, which he dedicated to the Queen. An account of his wonderful performances was read before the Royal Society, and was afterwards printed in the sixtieth volume of the *Philosophical Transactions*.

CHARLES WESLEY, at the age of two years and nine months, played a tune in correct time. Not long after, he could play any tune by ear, and supply an harmonious bass to it. When he was asked to play to any of his parent's friends, he would ask, "Is he a musicker?" and if the answer was Yes, he would immediately rush to the instrument and play.

WILLIAM CROTCH, at a year and a half old, would leave his food to listen to music. At two years he would strike the two or three opening notes of the tune he wished his father to play to him. At two years and three months he could play great part of "God save the King" with one hand. In a day or two he mastered the whole of it, and in a few months more he could play "Hope, thou nurse of young desire," from "Love in a Village."

Wonders of the Atmosphere.

THE MIRAGE—SPECTRE OF THE BROCKEN.

THE beautiful, deceptive phenomenon known as the mirage is of three distinct kinds. First, there is that form of it where some distant object, below the line of the horizon, and consequently out of the range of vision, seems to be lifted up into mid-air, and to hang suspended there—sometimes in its natural position, sometimes upside down, and sometimes both ways at once; the image in this latter case being doubled, like a ship and its reflection in the water. Secondly, there is that form of it where some object high up in the air, such as a cloud or a village on a hill, seems to be brought down and to lie floating in a vast lake stretching miles away at the spectator's feet. Thirdly, there is that less frequent form of it, where the setting sun appears to fling huge shadows of terrestrial objects far out into space.

Of the first kind of mirage there are some very striking instances on record. While sailing in the Polar seas, in 1822, Captain Scoresby saw the inverted image of a ship, apparently suspended in the air, some miles distant. "It was," he writes, "so well defined that I could distinguish by a telescope every sail, the general rig of the ship, and its particular character, insomuch that I pronounced it to be my father's ship the *Fame*, which it afterwards proved to be; though on comparing notes with my father when we met, I found that our relative position at the time gave our distance from one another very nearly thirty miles, being about seventeen miles beyond the horizon, and some leagues beyond the limit of direct vision." In May, 1854, the captain of H.M.S. *Archer*, while cruising in the Baltic, saw a similar mirage of the whole British fleet, consisting of nineteen sail. Here, again, the distance between the vessels was found to be full thirty miles. In both these instances the objects seen were inverted. On the 26th of June of this year, at Hastings, a more striking example of mirage was witnessed. The whole of the coast of France, from Calais to Dieppe, though more than fifty miles distant, and quite out of the range of ordinary vision, seemed to be lifted up into mid-air, and was seen there, not inverted, but in its natural position, during the space of three hours, by hundreds of persons assembled upon the beach. The most remarkable instance of all, however, is that recorded by Dr. Vince. From Ramsgate, the four turrets of Dover Castle may be seen on a fine day over the top of an intervening hill. While looking in this direction one evening, Dr. Vince saw the whole castle, not lifted up in the air above the hill on the other side, but to all appearances brought over bodily on this side of it. "So strong was the image," says Dr. Vince, "that I could not see the hill through it." The double mirage is seen oftenest on the shore of the Straits of Messina, where the phenomenon is known as the Fata Morgana. The images of men, horses, houses, and ships are projected into the air feet to feet, or keel to keel, as the case may be, until the atmosphere looks like one huge lake, in which all these miscellaneous objects are seen floating about together.

The second kind of mirage—that, namely, in which the object is brought down instead of being elevated—is most frequently seen in the arid deserts of Lower Egypt, where it often proves cruelly deceptive to the thirsty traveller. Dotted about the waste are elevations, on which the natives have built their villages, in order that they may be safe from the flood during the periodical inundations of the Nile. In the heat of the day, the mirage brings down an image of the sky upon the level, some few miles in front of the caravan, and produces the effect of a broad expanse of water, in which each village, brought down also, appears as an islet. Lured on by the refreshing prospect, man and beast push hopefully forward, often miles out of their track, to find the waters and the islands constantly receding from their view, until the evening comes, and they vanish altogether. So complete is the delusion, that not only experienced and scientific travellers, but even the Arabs themselves, are often deceived by it.

The third kind of mirage is seen only from the top of the Brocken, the highest summit of the Harz Mountain range in Hungary. It is there known as the Brockengespenst, or "Spectre of the Brocken;" and very spectre-like it looks in the red evening sun. You no sooner step out upon the plateau on the top of the hill, than your shadow, grim and gigantic, is apparently flung right out against the eastern sky, where, with all visible space for a play-ground, it flits swiftly from place to place, following your every movement. The illustration on the opposite page will enable our readers to judge for themselves of this weird-looking phenomenon better than any description in words. It is only in the evening just before sunset that the phenomenon is visible, so that the shadow is doubly exaggerated, first by the distance and level of the sun, and then by the distance of the surface upon which it is projected.

Each of these different kinds of mirage has its own separate cause, though they all depend for their existence upon a special state of the atmosphere. Before the phenomenon is possible the air must be divided into strata of different degrees of density. That done, the mirage follows, sometimes by refraction, sometimes by reflection, sometimes by the projection of shadows. Let us take the mirage by refraction first. Place a shilling in an empty bowl, and walk backwards until the coin, being hidden by the rim of the vessel, is no longer visible to you. Now, standing just where you are, ask a friend to fill the bowl with water, and as he does so the coin

THE SPECTRE OF THE BROCKEN.

will gradually come back within the range of vision, and you will see it as plainly as ever. How is this? You have not moved, and the coin has not been moved. No; but the straight ray of light which, passing from your eye to the basin, enabled you to see the coin at first, has been bent in passing through the water, and you are now able, as it were, to see round a corner. This is precisely what takes place in cases of mirage like that seen by Captain Scoresby and by the people on the beach at Hastings. The rays of light thrown back by the ship in the one instance, and by the French coast in the other, would, in ordinary states of the atmosphere, have shot outward and upward high into the air, and left the objects from which they were reflected totally invisible to persons at the distances of thirty and fifty miles. But in both cases the intervening air was ranged in strata of different degrees of density; and just as the ray from the coin in the basin is bent by passing through the water, so were the rays from the ship and the coast bent in passing through a layer or layers of denser atmosphere.

The kind of mirage which, like that seen by the traveller in the desert, brings the object down instead of elevating it, is accounted for differently. In the former case we had refraction, here we have reflection. The terrible heat of the sand rarefies the air nearest it, and, contrary to what is usual in nature, forces the denser atmosphere into a stratum above it. The two strata meet like two pieces of glass, one laid on top of the other, and where they join a surface is formed, which, like a lake, reflects back all objects above it. It is in this way that an image of the sky is brought down to look like water in the desert, the illusion being rendered the more perfect very often by the ripples that run over the surface of air.

The explanation of the Spectre of the Brocken is very simple. To the east of the Harz Mountains there is always a very dense and hazy atmosphere, so dense that it presents a surface capable of receiving the impression of a shadow and of retaining it as a wall does. When, therefore, the sun gets round to the west, the shadows of all objects that are near enough to this surface are projected upon it. It is not the fact that these shadows are flung out, as they appear to be, upon what is called the sky, they are all close at hand. And the chances are that if it were possible to walk straight out towards them from the top of the Brocken, the spectator would very soon get behind them.

To produce the mirage in miniature, let the reader take a red-hot poker and look along it horizontally towards an object (say some letter of the alphabet) stuck upon the wall a few feet away. He will soon see the inverted image of the object a few inches from the end of the poker, and a few inches above it.

Wonderful Numbers.

THE MAGICAL SQUARE.

A REMARKABLE curiosity in numbers is the magical square. It consists of numbers so disposed in parallel and equal lines, that the sum of each line, taken any way of the square, amounts to the same. To work this out, it is necessary, first, to form

A NATURAL SQUARE.

A G B

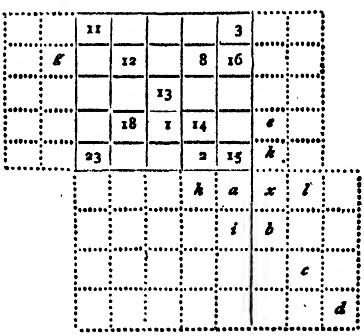
		3	4
6	7	8	9
			14
16	17	18	19

C H D

These numbers are to be transposed as follows to form the

13	21	9
1	14	22
19	2	15

First, the rank E F in the natural square to the diagonal A D in the magic square. Then the rank G H to the diagonal B C. Then 1 to the space under 13, and 2 in continuance of the diagonal below to the right. Some attention to the following diagram will be necessary, to make the remainder of the operation intelligible:—



In continuance of the diagonal from 1 downwards, 3 falls out of the square into the right-hand corner of a supposed square placed underneath, at *a*. For this reason the 3 has been placed in the corresponding corner of the magical square. In the same continued line, 4 would fall into a second supposed square, at *b*. It is put in the corresponding part of the magical square. So, 5 would fall in the supposed space *c*, and it occupies a similar space in the magical square. But 6 falls in

d, the corresponding space to which is occupied by 1; we therefore begin a fresh diagonal, and place it in the magical square beneath 18. The digit 7 is now placed in a diagonal line before 8, and after 8, still proceeding diagonally, we place 9. This would make 10 fall out of the square into a third supposititious square, at *e*. It is therefore placed in the corresponding part of the magic square. The figures from 11 to 15 are already placed; 16 would fall in the first corner (marked *x*) of the second supposed square; but the corresponding corner of the magic square is occupied by 11. We find the place it must occupy, by supposing the diagonal from 18 to be continued into a fourth supposititious square at *g*; the next number, 17, then comes in order before 18, and 19 follows in the same line; 20 falls out of the square at *h*, which marks its position, and 21 would fall at *i*, but that part of the magical square is occupied by 16; we begin the next diagonal with it, and in the same line place 22. This brings 23 to the corner of the third supposed square, *k*, and 24 to *l*, near to which is the place of 25.

This being done, it will be found that the sum of every row of figures in the magical square, taken in a right line, makes 65. Any series of odd numbers in arithmetical progression may be worked in the same way.

Wonderful Literary Forgeries.

CHATTERTON.

THOMAS CHATTERTON was born in November, 1752, the son of a verger and schoolmaster at St. Mary Redcliffe, Bristol. At five years of age he was sent to the district school, and in a short time was sent back to his mother as a "stupid boy." His mother had great difficulty in getting him to read, but when he was six years and a half old he was suddenly attracted by an illuminated music-book which his father had, belonging to the church. Over this treasure the lad pored, and soon mastered its contents, as well as those of a lumber-room in which several ancient books were kept. He went again to the free school, and at eight years of age was sent to Colston's charity school. There he devoured books, became noticeable on account of his studious habits, and for an intellectual pride, which operated even at that early age to prevent his competing with his fellows for the school honours. He wrote satires upon the masters and the boys, spent all his holidays (saints' days were holidays then) and all his play-time in studying old books, and in reading all the poems, especially quaint old poems, he could lay his hands on. Stow, Camden, Fuller, Speed, Macpherson's Ossian's Poems, and Mason's Poems, he read, and his imagination was greatly impressed by the "Castle of Otranto," published about this time.

When he was fifteen years old, he was taken from school and articled to Mr. Lambert, an attorney of Bristol. The office work had little attraction for him, and he neglected it in favour of more congenial studies. During the three years he passed at Lambert's, Chatterton contrived to find time not only to study, but to write upon what he had studied; and many were the contributions he made at this time to the London magazines as well as to the Bristol newspapers. Antiquity threw its wondrous charm over him, and made him a faithful votary at her shrine; he wrote upon the antique, and was led in the fervour of his devotion to copy the antique. He knew the old words which have passed by non-use out of the language; he knew the old modes of expression; and he could write the old character as well or better than he could write the new. His very breath seemed to be drawn from four centuries back. Poverty, an intellectual desire to mock ignorance, and a cynical contempt for the vanity of the wise, tempted him to plan a gigantic literary forgery, for the execution of which his studies afforded him unusual facilities. When the new bridge was opened at Bristol, in 1768, he wrote in Felix Farley's *Bristol Journal* an account of the opening of the old one, in which he described with much circumstance and minuteness the ancient ceremonial—monks passing over the bridge, chanting hymns, the city authorities in grand array, and the citizens of Bristol in civic procession. The account, well written, and so full of archæological interest, attracted much attention, and Chatterton, on being questioned as to his authority for the statements, said he had found the account in a number of old manuscripts which his father had given him, and which had been discovered in a muniment chest in the church many years before. He was visited by local historians and archæologists, who received from him, as a special favour, portions of the old manuscripts said to have been found in the muniment chest. Then he published a series of poems, written, as he alleged, by Rowley, a monk of the fourteenth century; poems which had remained hidden in the church chest, but which were full of beauty of thought and expression, though worded in quaint old language. These excited universal admiration. Chatterton sent copies of some of them to Walpole, and asked his assistance. Walpole says he knew them at once for forgeries; he gave no help, though he corresponded with the poet, and made some inquiries about him through friends in Bristol. The literary world was divided; some thinking the Rowley Poems, which were very voluminous, genuine productions, others adopting Walpole's belief that they were forgeries. They were, in effect, forgeries, but of what kind, and by whom? Herein is the wonder. The poems were written on parchments which seemed begrimed with the dust of ages, and in ink that looked as if it were pale with watching through the many years

that must have elapsed since it was first used. There was nothing to show that the age-stained complexion of the parchments had been obtained by means of ochre and floor-dust rubbed industriously into their surface, or that the ink with which the writing had been done had been diluted before use, or that the written sheet had been subjected to further dulling causes that hid effectually the modernness of its birth. The caligraphic characters of the fourteenth century, admirably imitated, betrayed no secret. There was nothing in the mechanical contrivance of the fraud by which its true nature might be known. For the poems themselves, they were the beautiful emanations of a brain bountifully endowed with "the gift and the faculty divine," but which was pleased for some reason, it were hard to find what, to clothe its thoughts in an ancient dress, and to give the honour of the authorship to another. They were poems that bore the stamp of genius on every line, and that excited the just admiration of an age remarkable for the fastidiousness of its taste. They were written, not by a man trained in the "accomplishment of verse," educated in the mysteries of antiquity, or fitted by long experience in literary work; but by a youth of seventeen and a half, a charity school-boy, an attorney's apprentice, who was indebted to himself for his education, and to Nature for that genius which made him a wonder of the world. His brain teemed with productions in prose and verse on all sorts of subjects: history, poetry, archæology, mental philosophy, the drama, essay writing—all these were within his range, and he sent forth unceasingly supplies of literary matter, which, alas! were all he had to depend on for his existence.

Baffled in his attempts to get recognised by the leaders of literature, injured by the recoil upon himself of his deceit about Rowley's poems, hungry for fame and not satisfied, hungry for bread, and not satisfied in that particular either, too proud to beg, too weak to fight on alone and unassisted, he took poison and died in August, 1770, in the nineteenth year of his age.

Walpole, on being charged with having been an accessory to his death, by neglecting him, had the heartlessness to write, "He had no more principles than if he had been one of all our late administrations. He was an instance that a complete genius and a complete rogue can be formed before a man is of age." Surely this language justifies the words which Chatterton had used by anticipation of his censor:—"Oh, ye who honour the name of *man*, rejoice that this Walpole is called a *lord*."

When too late, the world began to recognise the extraordinary, though misapplied, talents of the neglected boy-poet; and the visitor to Bristol may see in the churchyard of St. Mary Redcliffe a beautiful monumental effigy of the "marvellous boy."

Wonders of Natural History.

WONDER OF THE SPIDER'S THREAD.—That any creature could be found to fabricate a net, not less ingenious than that of the fisherman, for the capture of its prey; that it should fix it in the right place, and then patiently await the result, is a proceeding so strange, that if we did not see it done daily before our eyes by the common house-spider and garden-spider, it would seem wonderful. But how much is our wonder increased when we think of the complex fabric of each single thread, and then of the mathematical precision and rapidity with which, in certain cases, the net itself is constructed; and to add to all this, as an example of the wonders which the most common things exhibit when carefully examined, the net of the garden-spider consists of two distinct kinds of silk. The threads forming the concentric circles are composed of a silk much more elastic than that of the rays, and are studded over with minute globules of a viscid gum, sufficiently adhesive to retain any unwary fly which comes in contact with it. A net of average dimensions is estimated by Mr. Blackwall to contain 87,360 of these globules, and a large net of fourteen or sixteen inches in diameter, 120,000; and yet such a net will be completed by one species in about forty minutes, on an average, if no interruption occurs!—*Introduction to Zoology.*

A FISH in Java, called the "jaculator," catches flies and other insects by squirting from its mouth some water, and seldom misses its aim at the distance of five or six feet, bringing down a fly with a single drop.—*Mitchell.*

THE elephant throws out sand from his trunk to blind man and horse, and then rushes on them. —*Denham and Clapperton's "Discoveries in Africa."*

WILD ducks are estimated to fly ninety miles an hour; swallows fly rather faster, and the swift flies above two hundred miles in an hour.

LEUWENHOEK affirms that he saw hundreds of animalculæ in the space of a grain of sand, and ten thousand organised beings.

A SINGLE female house-fly produces in one season 20,080,320.—*Haller.*

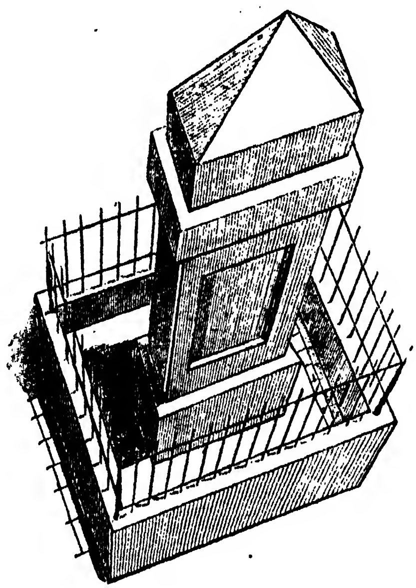
ONE pair of pigs will increase in six years to 119,169, taking the increase at fourteen times per annum. A pair of sheep in the same time would be but sixty-four.—*Allnut.*

THE ANTIPATHY OF FLIES TO THE MAGNET. —A person having an artificial magnet suspended from the wall of his study, with a piece of iron adhering to it, remarked for several years that the flies in the room, though they frequently placed themselves on other iron articles, never settled on the artificial magnet, and even that if they approached it, they in a moment again removed from it to some distance.—*Voight's Journal.*

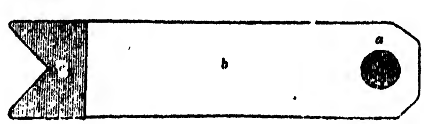
Wonderful Optical Illusion.

THE HORIZONTORIUM.

Many of the parlour pastimes which delighted and amused us oldsters when we were youngsters have been superseded and forgotten, some deservedly so, but others from their ingenuity deserve to be rescued from the unmerited oblivion into which they have fallen. Among these was a curious optical illusion called the Horizontorium, and as the effect is both pleasing and astonishing, perhaps a short description may not be considered out of place if inserted in these pages.



The original designs were published at Liverpool some forty years back, and consisted of a castle or fort, with turrets, palisadoes, a magazine, and a sentry standing outside of his box, also the roof of a cottage on one side. When viewed from any other than the one point of sight, it is difficult to imagine what the design is intended to represent, as the walls of the castle appear to slope outwards, so that they are nearly twice as wide at the top as at the base. The soldier and his sentry-box have a most singular effect, the former appearing a very tall figure in height, while his breadth scarcely exceeds that of his musket.



To produce a regular picture from this almost shapeless assemblage, all that is necessary is to view it from a certain point, with one eye only, which is best done by the help of a sight made of pasteboard or card, which accompanies the original. When viewed by these means, it is impossible to describe the beautiful effect produced. It is not a picture, but a reality. The castle walls and palisadoes resume their regular proportions. The sentinel is reduced to proper dimensions, and the effect of light and shade is almost miraculous. The whole has the appearance, not of a picture, but of an exact miniature model of the things intended to be represented. The illustration which accompanies this article will give a fair idea of this curious illusion. In order to realise all the effect, it is necessary to observe carefully the following directions:—A piece of paper, or, what is still better, a slip of cardboard, must be cut out of the exact size and shape of the figure *a*, *b*, *c*, an aperture for the eye, about the size of a pea, *a*, must be made precisely on the spot shown in the sight-piece. The shaded part of the sight-piece must be folded back at a right angle, so as to form a kind of foot to stand upon. The sight-piece must then be placed perpendicularly, exactly over the piece, *d*. Then keeping the paper perfectly horizontal, and placing the eye close to the aperture, *a*, there will be seen a perfect representation of a tombstone surrounded by railings. A little experience will enable one to see the image very exactly; if not, the person who makes the trial may depend upon it that he has not placed the sight-piece correctly.

d

The light should fall on the side of the figure opposite the shadow. If the representation of the figure *a*, *b*, *c*, is found to interfere with the picture, it may be covered by a small piece of white paper. Special care must be had that the paper be perfectly smooth, as the slightest wrinkle will distort the figure materially; also remember to shut one eye, and place the other as close as possible to the sight-hole.

It is possible to multiply designs to any extent, as the principle upon which the Horizontorium is constructed is very simple. Any design may be made of any object, if it be drawn in isometrical perspective—that is, with the vanishing point below the plane of the picture, which point becomes the station for the sight piece. If the picture be carefully drawn, the effect of reality will be as good as that given by the stereoscope. All those who have any notion of drawing, may, by the exercise of a little ingenuity, and at the expense of a few hours' time, not only give themselves employment during the winter evenings, but also give pleasure to their friends.

Wonders of the Ocean.

A WONDERFUL SOUNDING.

"THEY who go down to the sea in ships" do indeed "see the works of the Lord, and his wonders in the deep." Here is the story of a wonder not less astounding than the wonder of the high mountain, told by one of those who was engaged for many years in a professional examination of the wonders of the ocean, and whose daily business it was to pry into the secrets of the great deep.

It had long been a question what was at the bottom of the sea; and though this question had been answered more or less fully concerning regions where the depth was not very profound, there had always remained the puzzle of the so-called "bottomless" seas—that is to say, of seas where the volume of water was so out of proportion to the measuring power of the surveyor, that its dimensions could not be gauged. By the exertions and skill of various marine surveyors, waters which to the earlier navigators had been bottomless, were fathomed, and specimens of the bottom obtained. The Americans have done much in this direction, and to them we are indebted, not only for a highly ingenious sounding apparatus, but for some carefully conducted soundings obtained with it at a distance of nearly four miles down in the bosom of the Atlantic. The Americans, however, had given up as useless any further attempts to sound at greater depth; they reported that in the deeps deeper than the deepest there were physical and mechanical difficulties which rendered true sounding an impossibility—the ships drifted, the sounding-line got out of the perpendicular, currents ran off with the plummet, something or other came in the way to prevent success.

It seemed desirable to Captain Denham (now Rear-Admiral Sir Henry Denham), when in command of H.M.S. *Herald* on surveying service, to ascertain for himself whether he could not find a bottom to the bottomless sea. He received a supply of sounding-line, fifteen thousand fathoms in length, which had been made specially for sounding purposes, and which was presented to him by the American Commodore M'Ivor, who had himself been engaged in trying experiments in the ocean.

Captain Denham elicited all the information the American officer could give as to the sounding process the latter had adopted. The Americans had hove their lead from the ship. This Captain Denham felt convinced was wrong; he knew by experience the difficulties there were in getting proper results by this means, and resolved to profit by his friend's discomfiture in conducting his own experiments.

He chose a day when sea and air combined to produce such a calm as is seldom seen in the midst of the Atlantic, where he then was, half-way between Buenos Ayres and Tristan d'Acunha. Two boats were lowered, and in one of them the sounding gear was placed. At a short distance from the ship, so as to be out of the influence of her attraction, an ordinary deep-sea lead was cast from the sounding boat, until the plummet having arrived at the dead-water level, where the action of wind and surface motion is not felt, brought the boat up, holding her as though she were at anchor. The crew were ordered to keep the blades of their oars just moving, so as to keep the boat to her anchorage, while a painter made fast to the boat ahead served as an additional check. Upon a great reel, rigged winch fashion in the bow of the sounding boat, was the very deep sea lead line, one-tenth of an inch in diameter, and weighing, when dry, one pound per hundred fathoms. The plummet weighed [illegible] pounds, was eleven inches and a half long, and one-seventh of an inch broad.

Everything being ready, the plummet was let go at 8.30 a.m. The first hundred fathoms of line cleared out in a minute and a half; the second in two minutes five seconds; and the time for every succeeding hundred fathoms increased gradually; so that, whereas the first thousand fathoms ran off in twenty-seven minutes fifteen seconds, one hour forty-nine minutes and fifteen seconds was the time required to get out the seventh thousand. After 7,706 fathoms, or eight and three-quarters English miles, had run off, bottom was reached, the operation having lasted nine hours twenty-five minutes. "That bottom was reached there could not be any doubt, the extreme stillness of the water enabling the sounders to perceive the same indications of touch as would have manifested themselves with casts in much shallower water. Again and again the line was tried, and stopped always at the same mark; several sets of hands tried the line, and each verified the report of their predecessors. The beat of the lead on the bottom was as distinctly felt as if an electric shock had been passed through the line."

Wonderful Numbers.

CERTAIN wonderful properties of numbers are illustrated by what may be called tricks. For example, to make any number divisible by 9, you have but to place a certain number between two of the figures. Thus, given the number 29 to be divided, the product is 3 and 2 over; but place 7 between the digits, and there is no remainder, for

$$279 \div 9 = 31.$$

Again, let the number given be 64324, the product divided by 9 will be 7147 + 1, but interpose 8 between any two of the figures, and nothing will remain. The curiosity of this lies in the fact that it is of no con-

sequence at what part of the dividend the figure is added. Thus:—

9)6*4324 76036	9)64*324 72036	9)643*24 71536
9)6432*4 71476	9)64324* 71472	9)*64324 96036

Or, take a longer number for the dividend, say, 6038478643269846. This, we shall find, is not divisible by 9. But if 6 be added between any two of the digits it will be found exactly divisible.

9)6*038478643269846
733760873814 1094

We need not ring all the changes, but will try only two more.

6038*478643269846 670960873814 1094	9)6038478643*269846 670942071514 1094

It is not always possible to explain the reason of what happens in dealing with numbers, unless appeal can be made to an amount of mathematical knowledge which is not commonly possessed. As a single step towards understanding the above curious phenomenon, let us see what the result would be of dividing the number we have already taken, 64324, by 9, changing the order of the digits, but adding nothing to them.

9)64324 7147+1	9)63424 7047+1	9)62344 6927+
4975+1	9)43426 4825+1	9)46243 5138+1
3807+1	5159+1	9)23446 2605+1

So it appears that in whatever order we place the digits, the remainder is 1. For this reason we added 8 in the first example. If a number had been chosen, which resulted in a remainder of 4 when divided by 9, the number to add would have been 5; because $5+4$, like $8+1=9$, and 9 is, of course, exactly divisible by itself as a factor. The only other digit that can be used in the same way is 3, because $3 \times 3=9$.

WONDERFUL MECHANICAL CONTRIVANCES.

MANY attempts have been made, from very early times, to imitate the motions of animals by mechanical contrivances, and some have been remarkably successful. The story of ancient writers, that Archytas of Tarentum, who lived B.C. 400, constructed a pigeon that could fly, but, when once it alighted, could not resume its movement, is open to doubt; but we have better authenticated narratives of equally wonderful inventions in a later time, and in some cases their truth is absolutely certain. It is said that a German artist named John Müller, sometimes called Regiomontanus, constructed an artificial eagle, which, on the entry of the Emperor Maximilian into Nuremberg, flew to meet him, and returning, alighted on the gate of the city to await his approach. Müller is also said to have made an iron fly which flew from his hand, and returned to it after performing a considerable round. Some little doubt has been cast upon the authenticity of Müller's reputed inventions, but the following are beyond dispute.

General De Gennes, who defended the French colony of St. Christopher, in the West India Islands, against the English in 1688, was remarkable for his great mechanical skill. Among other contrivances, he made a peacock that walked about as if alive, picked up grains of corn, and not only swallowed them, but digested them in its stomach.

Wonderful as this was, its ingenuity was outdone by that of a duck made by a Frenchman named Vaucanson, which was exhibited in Paris in 1738. It was of the natural size, was clothed with feathers, and all the bones of the living object were imitated in their exact position by the mechanism of the interior. When set in motion, it performed the movements of a duck exactly. It moved its wings, ate and drank in the manner of the original, and all the usual processes of digestion were carried on in the stomach, partly by means, it is presumed, of a chemical solution. It also quacked like a duck, and is said, in drinking, to have muddled the water with its bill.

Beckmann, who travelled in Russia in 1764, saw at the palace of Zausko-Selo, near St. Petersburg, a collection of automata which were reputed to have been purchased from Vaucanson after he had exhibited them through Europe; and among them was the duck above mentioned. It still ate, drank, and moved, and as most of the feathers which had covered the ribs were then lost, the interior construction was exposed to view. The observer relates that the motion was communicated by means of a cylinder and fine chains, like the mechanism of a watch, all proceeding through the feet of the duck, which were of the usual size.

Vaucanson also constructed an automaton flute-

flute, and the holes being opened and shut with its fingers. This also was among the relics of the French artist which Professor Beckmann saw, but it then emitted only a few faint tones.

Vaucanson's flute-player has since been imitated with complete success. Some years ago we ourselves saw, at an exhibition of curious mechanism at the Adelaide Gallery in London, two automaton flute-players, representing the figures of two ladies, seated, and the size of life, which were playing duets in the manner of the living performer, and producing considerable variety of tone from the instruments. The notes, it is true, had a hollow and dreary sound, and the figures were somewhat ghastly; but the mechanism had evidently been constructed many years before, and was no doubt very much out of order.

of Natural

THE ELEPHANT.

THE proboscis of the elephant is the most remarkable feature in his formation, and is capable of being put to a great variety of uses. Through it the animal breathes, drinks, and smells. It is so pliant that it can be made to move in any direction, and so strong that it is impossible to take anything away from its grasp. It is hollow from end to end, and divided throughout with a partition. At the very point of it, just above the nostrils, the skin is extended into the shape of a finger about five inches long. By means of this the animal is able to take a pin from the ground, untie the knots of a rope, and unlock a door. Œlian relates even a more wonderful use to which he saw it put. "I have seen," he says, "an elephant writing Latin characters on a board in a very orderly manner, his keeper only showing him the figure of each letter."

IT is not long since the public were astonished by the feats of Blondin on the high rope at the Crystal Palace. But still more wonderful performances are on record. In the time of the Emperor Galba, an elephant was made to walk backwards and forwards on a rope, across the open space of one of the great amphitheatres. The authorities for this are quoted by Justus Lipsius in his "*Epistolarum Selectarum Censuria*," published at Antwerp in 1605. According to Leibnitz, in the year 1237, at the wedding of Robert, brother to the king of France, a horse was ridden upon a rope.

ABOUT the year 1767 a cutler at Sheffield, in sawing through an elephant's tooth, met with a resistance which he found very difficult to overcome. On examination, he found it was an iron bullet, which had lodged in the very body of the tooth without any visible external mark of the place where it had entered. In 1801, Mr. Combe described to the Royal Society an elephant's tusk with the iron head of a spear completely imbedded in it; he judged from the position in which it was found that it had been driven right through the skull, at a point close to the tusk. It then appeared to have followed the natural direction of the cavity, and thus pointed downwards to the apex of the tusk. It is asserted by those who have experience in such matters, that other foreign substances are frequently found imbedded in the tusk of the elephant.

WONDERFUL HIGHWAYMEN.

MACAULAY has given a very graphic description of the mounted highwaymen that were wont to infest the principal roads; and other writers have dwelt upon the deeds of these lawless freebooters, attaching so great a romance to men whose audacity and ferocity often brought them to the gallows, but who occasionally displayed acts of good nature, nobleness, and generosity. Claude Du Val, who was French page to the first Duke of Richmond, has been immortalised in the celebrated print, which shows him in the act of dancing a *coranto* on the heath with a lady of quality, he having suffered the fair owner to ransom three hundred pounds by giving him her hand in the measured step. Nor was this system of polite plundering confined to England, for it is recorded that in August, 1776, a lady and her servant, when riding in the Phœnix Park, Dublin, were stopped by a man on foot, remarkably well dressed, in a suit of white and a gold-laced hat. He demanded the lady's money, which she gave him, amounting to twenty-six guineas, when, having put the cash into one of his pockets, he took from the other a small diamond hoop ring, which he presented to the lady, desiring her to wear it for the sake of one who, though a robber, made it a point of honour to take no more from a beautiful lady than he could make a return for in value. He then politely bowed, and, vaulting over the wall, disappeared.

It often happened that highwaymen paid the penalty of their temerity, many having been shot when attacking travellers. The story of a nobleman saving his own life, and taking that of his opponent by an adroit expedient, is well known. "Your money or your life!" said the hero of the road, presenting a cocked pistol at the window of a carriage on Hounslow Heath. "I would not yield to one man," responded the occupant of the vehicle, "but as there are two of you I must." The robber, taken aback, looked round to see where the second man was, and at that moment received a bullet through the heart from his intended victim. Upon another occasion, in 1775, the wich stage was attacked on Epping Forest by seven highwaymen, three of whom were shot dead by the guard, but his ammunition failing, he was himself killed, and the coach was robbed by the survivors. The chief magistrate of the City of London and his suite seem upon a memorable occasion to have thought that discretion was the better part of valour, for in 1776 the Lord Mayor was robbed near Turnham Green in his chaise-and-four, in sight of all his retinue, by a single highwayman, who swore that he would shoot the first man that made resistance or offered violence. Occasionally these maurauders took to the "silent highway" as well as the road, for in June, 1771, three gentlemen and two ladies returning from Vauxhall Gardens by water, were boarded within two hundred yards of Westminster Bridge by six men who had their faces covered with black crape. These river pirates demanded the money of the party under the threat of throwing them overboard, and, after robbing them of twenty guineas and two gold watches, quietly rowed away up the river.

Wonders of Construction.

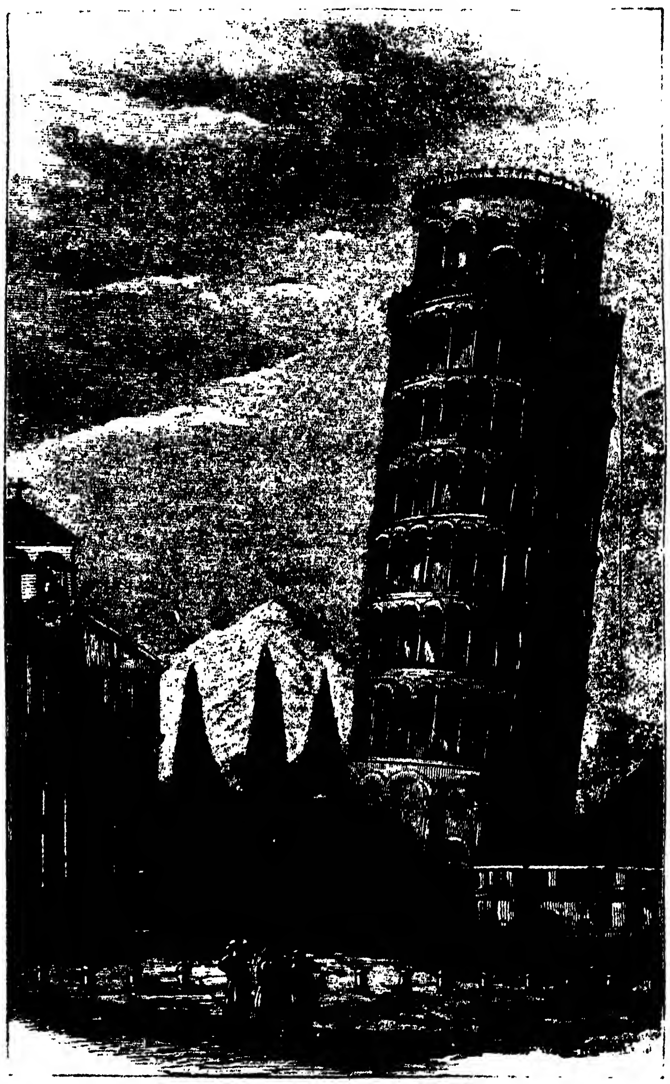
THE LEANING TOWER OF PISA.

PISA is one of those old Italian towns which occupied a prominent position, and played an important part in mediæval history. It is said to have been founded about 600 years B.C., and was a town of the ancient district of Etruria. In recent times it belonged to the Grand Duchy of Tuscany, now incorporated in the Kingdom of Italy.

Pisa is chiefly celebrated now for its wonderful Leaning Tower, a representation of which is given in our illustration. This was erected about the year 1150, by the German architect Wilhelm of Innsbruck. It was designed as a belfry for the cathedral, and stands in a square close to the building to which it is attached. We may remark, in passing, that the erection of belfries apart from the churches was common in the early days of ecclesiastical architecture; and many instances of this peculiarity are to be found in this country.

The leaning tower is built wholly of white marble, and consists of eight circular stories, each ornamented with rows of columns, and gradually narrowing in width from the base towards the top. The summit is a flat roof, with an open gallery, which commands a magnificent view. Its height is 188 feet, or about fourteen feet less than that of the monument in London.

The tower leans so much from the perpendicular, that a plummet dropped from the top falls at a distance of about fifteen feet from the base. The ordinary observer wonders that, with so great a deviation, it does not come to the ground; but it stands in obedience to the law of physics, by which any body of matter will maintain that position so long as a perpendicular line drawn from its centre of gravity shall fall within its base. The "centre of gravity" may be explained, to those who are unacquainted with scientific terms, as the *balancing point*, or point at which the entire weight of a body will be equally divided, and exactly balanced on the one side and on the other. As this point is found in the leaning tower to fall within the space covered by its foundations, there is no reason why it should not continue to stand, as it has done, for many centuries to come.



THE LEANING TOWER OF PISA.

The appearance of the tower has led many to suppose that the law above mentioned is actually violated; and, in fact, so nearly is the limit of compliance with it approached, that scientific observers have occasionally formed the same opinion by calculation, and have been forced to the conclusion that the building was held together only by the great tenacity of the mortar: but the balance of

authority, as well as of probability, is against this conclusion.

As to the *cause* of the inclination of the tower, opinions have also been divided. Some have attributed it to a subsidence of the foundation, or a movement of the adjacent earth. But others have contended, with more show of reason in support of their argument, that its leaning was the original device and purpose of the architect, and that it was therefore one of those triumphs of architectural skill which in the middle ages would have been cordially welcomed and appreciated. Captain Basil Hall made a series of careful investigations on the subject, and established, as he believed, to demonstration, that the tower was built as it now stands. He found that the line of the tower, on the side towards which it leans, has not the same curvature as the line on the opposite side. If, he remarked, the tower had been built upright, and then made to incline over, the line of the wall on the side towards which the inclination was given would be more or less concave; but he found the contrary to be the fact, the line of the wall on the leaning side being decidedly more convex than that on the opposite side. Captain Hall had, therefore, no doubt whatever that the design of the architect was apparent in every successive layer of the stone.

These conclusions are partly supported by the remarks of another scientific observer, to the effect that the name of "the Leaning Tower" does not convey a true notion of the form of the building. It is, he remarks, in fact, a "twisted" tower, there being an irregular curvature in the building. But he conjectures that this "twist" was due to the subsidence of the foundation during the erection, and an attempt on the part of the architect to "right" the building as the work proceeded.

We may add that from the leaning tower of Pisa the great astronomer Galileo made, early in the seventeenth century, a series of observations from which he deduced the principles of the gravitation of the earth.

AERIAL COMBATS.

In a pamphlet published, as the title-page runs, for "B. B., London, in 1622," we read that in the twelfth year of the reign of Richard II. a battle was fought between gnats at Shene, now called Richmond: their multitudes were so great, that the air was darkened with them. It was computed that two-thirds of them were killed, and the remaining third suddenly vanished.

This account is inserted as preliminary to one of an engagement between the starlings at Cork, in Ireland, on the 12th of October, 1621; they mustered four or five days previously, every day increasing in number. Some came from the east, others from the west, and, as it were, encamped themselves eastward and westward of the city. During the time of their assembling, those who came from the east sought their meat eastward, and those from the west sought theirs westward; no one flying in the circuits of the other.

On Saturday, the 12th of October, they fought, and on Sunday none were to be seen. Upon this same Sunday a similar battle was seen between Gravesend and Woolwich, and there was a raven flying between the combatants.

On Monday, the 14th, they reappeared at Cork, and fought with as much violence as before, the dead and wounded falling on the houses, into the streets, and in the river. Besides the starlings, kites, ravens, and crows were found dead.

The work quoted is among the King's Pamphlets in the British Museum.

Wonders of Warlike Invention.

THE MONCRIEFF BARBETTE.

Great attention has been paid during the present century to inventions for warlike purposes, and the art of war has reached such a formidable stage of development, that philanthropists have ventured to hope the time must shortly come when war will cease to ravage the earth.

Warlike inventions range themselves in two classes—the one for offensive, and the other for defensive purposes. In the latter class ranks that now known by the title placed at the head of this paper. We shall give a brief description of this invention, sufficient to afford the reader some idea of its general character.

Most of our readers have seen a fort, and have observed that the cannon either look *through* openings made in the outer wall, or *over* the top of the parapet. The first plan of fortification is known as the *embrasure*, and the second as the *barbette* system. The barbette is a terrace formed inside the parapet, and the cannon are mounted on this terrace, at such an elevation that they may be fired in any direction over the top of the wall. This system gives freedom of movement in working the gun; but the disadvantage attending it is that the men who work it are necessarily greatly exposed to the enemy's fire. To remedy this disadvantage to some extent, the embrasure system was invented, the gun and the artillerymen both being enclosed and protected from fire, unless it should penetrate the opening made in the wall. This opening is usually shaped like a funnel, narrow at the outer side through which the muzzle protrudes, and widening inside so that the direction of aim may be altered by a movement of the body of the cannon.

But the embrasure system has its disadvantages also. The openings in the wall weaken the wall itself, and besides this, they present marks at which the enemy can fire, so that shot or shell glancing

through may effect great destruction. The great problem in artillery was, effectually to protect the men and the cannon they were working, and at the same time to preserve the power to use the guns freely for defence.

This problem has now been solved by Captain Moncrieff, an officer of the Edinburgh Militia Artillery, after many years devoted to the study of the subject. But its solution has depended on the settling of another question of great difficulty, to which we must next allude.

Every one knows that when a gun or pistol is fired, there is a *recoil* of the weapon, more or less severe in proportion to the charge of powder which has been used. The force with which a heavy cannon recoils is extremely great, and produces a severe strain upon its carriage and the works surrounding it. It is impossible to prevent this recoil, but the question had suggested itself to many minds whether this immense force could not in some way be turned to account. One idea was that it might be used to pull up another gun after the first had been fired; but the difficulties attending the working out of the suggestion were too great, and nothing came of it. Captain Moncrieff at length solved this question of utilising the recoil force, and with it the problem to which we before referred. His mode of doing so is as follows :—

The gun is placed in a circular pit, and the muzzle, when elevated, is on a level with the top, over which it can fire in any direction. It rests on a small iron carriage, and this lies between two *rockers*, the movement of which is dependent upon the motion of the gun. The rockers or elevators, as they are termed, are something like those of a boy's rocking-horse, to which the whole apparatus has been aptly compared. When the gun is fired, the force of recoil is imparted to the rockers, and the movement of these brings it down again to a position in which it is held until it is reloaded, both the gun and the men being meanwhile completely hidden from the enemy. Attached to the rockers is a box containing heavy weights, the raising of which checks the downward motion of the gun; and the depression of these weights, when the gun is loaded and the catch released, brings the cannon up again to the mouth of the pit to fire. The weight of the elevating machine, or rocking-chair, is about six tons.

The aim of the gun is directed by means of mirrors placed in the pit, and in which the men in charge can see all that is going on outside, while they themselves remain unobserved. The only danger they have to fear is that of shot or shell dropping in upon them from above. But the mouth of a sunken battery like the Moncrieff barbette presents so small and undistinguishable a mark, that this danger is in reality small, and it is possible, moreover, to protect the pit by an iron roof. The system is capable of application in a variety of ways, and it is thought it may be applied to ships as well as to land fortifications.

It will be seen from the foregoing account that the idea of the principle, like that of many other great inventions, is comparatively simple; but it has required long study to bring the details to perfection, and some time may yet elapse before all its capabilities are developed.

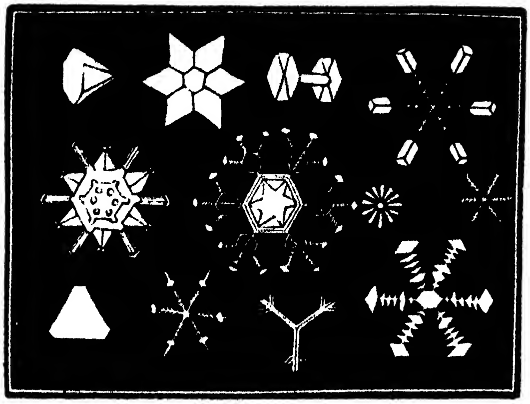
WONDERS OF THE SNOW.

THE ancient historian Herodotus tells us, in his gossiping way, that the Scythians reported of the country lying beyond them, and farther to the north, "that it could neither be passed, nor yet discerned with the eye, on account of the *feathers* which were continually falling. With these both the earth and the air were so filled as effectually to obstruct the view." He had himself sufficient acquaintance with natural phenomena to conjecture that by "feathers" the wild inhabitants of Scythia in reality meant *snow*; but it is more than probable that when the uninformed denizens of warmer latitudes first gazed, in their travels, on the spectacle of a snow-storm, they verily believed, and reported in all honesty, that feathers had been falling to the ground. The nursery story of the "old woman picking her geese" may thus have had its counterpart, in the infantile ages of the life of the human race.

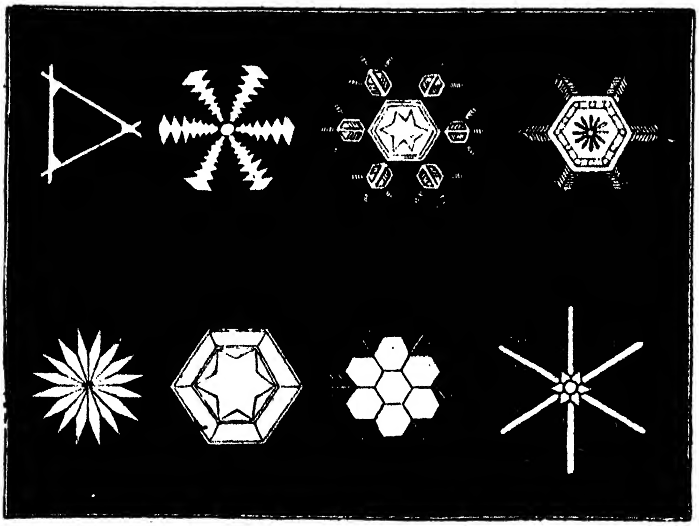
Snow is always a wonder to him who sees it for the first time, and, familiar as it is to us, we occasionally meet with people to whom it is utterly strange. Youths born in India, for example, on visiting England in winter, gaze upon a snow-fall with astonishment and admiration. "I do *so* want to see the snow coming down," observed such a young friend of ours; and he was not content until a severe winter fully realised his wish.

But there are wonders in the snow, with which many who look upon its coming as quite a matter of course may be unacquainted. Such a wonder is presented in the phenomena of *crystallisation*. Snow is produced by the freezing of moist vapours suspended in the atmosphere; and in very low temperatures the flakes or particles of snow are found to assume the most elegant and regular forms. These, from their perfect geometrical proportion, are denominated *crystals*, that name being applied to all particles of matter which take a definite geometrical shape. Snow crystals are of infinite variety and beauty. Captain (afterwards Doctor) Scoresby, the Arctic traveller, who was the first to observe them, gave ninety-six illustrations of their graceful forms, in his description of the Arctic Regions, published in 1820. From these we select a few, which will afford an idea of the character of the remainder.

It was at first thought that only such extreme cold as that of the Arctic regions could produce this crystallisation. On investigation, however, it was discovered that in our own severe winters the snow presents an equally wonderful appearance; and the eminent meteorologist, Dr. Glaisher, in 1855, gave to the world a representation of 150 figures from the snow, which had come within his own observation during the previous winter. These were quite as beautiful and diversified in character as those noticed by Dr. Scoresby in the Polar seas.



One striking feature in the snow crystals is this: that though differing so widely in character, they are all, or nearly all, hexagonal or six-sided in shape. Occasionally three-sided figures are seen, but these are very rare. Sometimes three of the sides are shorter than the other three, so that the figure is like a triangle with the points cut off; and now and then two small figures are connected together by a slender bar or link. These exceptional figures, as well as others more commonly discovered, will be found represented in our smaller illustration. As a rule, however, the hexagons consist of thin plates shaped like beautiful stars, and sometimes surrounded by other stars of similar nature. The great variety of these appearances is apparently inexhaustible, for each investigation has resulted in the discovery of forms previously unobserved, although possessing the general characteristics to which we have alluded.



The angle of sixty degrees is also found to prevail in all the various ramifications of these stars amid the snow, in conformity with the law by which water always crystallises at this angle.

EARTHQUAKES.

An earthquake is the most terrible of all the wonderful phenomena of nature; there is nothing which is so utterly appalling to the senses of those who witness it. The buildings which man has erected for his comfort and protection are crashing into ruin over his head, the solid earth trembles beneath his feet, or, yawning wide, threatens every moment to swallow him up; fire and water combine to add their terrors to the scene, and yet he is afraid to fly, for he feels that the very spot which he may choose as his vantage ground of safety, may chance to be just exactly over the focus of the earthquake's force.

It is not our intention here to discuss the various theories which from time to time have been started as to the origin of earthquakes. It is enough to say that it is considered most probable that they are the result of an imprisoned force, generated by the extreme heat which is supposed to keep the centre of our globe in a constant state of liquefaction; the same force that occasionally finds a vent in volcanoes, which act, so to speak, as safety-valves for its destructive powers.

Some countries are very much more liable to shocks of earthquake than others. In the old world those countries which lie round the Mediterranean are most subject to these disasters; and they also occur frequently, and often with very terrible effects, in the Indian Archipelago as far north as Japan. In America those countries which surround the Caribbean Sea and the Gulf of Mexico, as well as those that lie between the Andes and the Pacific, including also the mountain region itself, are the localities where earthquakes most frequently occur. The countries of Peru and Ecuador, the scene of the late terrible earthquake, lie within these latter limits.

Earthquakes occur much more frequently than most people suppose. Humboldt asserted it as his belief that if it were possible to obtain daily information respecting the state of the whole surface of the globe, we should probably convince ourselves that this surface is nearly always shaken at some point or other, though not, of course, always with any great degree of violence. The shocks vary, both in their intensity and in their mode of action. Sometimes they are so slight as to be scarcely perceptible, at other times they cause the most wide-spread devastation. Again, they appear sometimes as tremulous movements of the earth's surface, which do but little material damage, and commonly pass away in a moment, though they have been known to continue for several days together. At other times they are what is called undulating, the surface of the ground being alternately raised and depressed, not unlike the effect produced on the sea by a moderate breeze. More terrible in their nature are the

VIEW IN LISBON AFTER THE EARTHQUAKE. FROM AN OLD PRINT.

upheaving earthquakes, which raise up and burst open the solid crust of the earth. The effects which an earthquake of this nature sometimes produces are almost incredible.

But the most terrible of all, and happily those which occur most seldom, are those which are known as rotatory earthquakes. They are supposed to be the combination of the upheaving and undulating movements, and act upon the surface of the earth much as violent cross-winds do upon the sea. The results of these shocks are sometimes most extraordinary. In the earthquake of Catania, in Sicily (1818), several statues were found to have been turned quite round. At Concepcion, in Chili, in the year 1835, an angular stone pinnacle was found to have been turned half round, without being displaced from its base.

In the great earthquake of Calabria, in the year 1783, some extraordinary changes of position were effected. Houses were removed, and carried up to places higher than those they had originally occupied. In some places large pieces of ground exchanged their respective situations, and for several years after the earthquake, lawsuits used to be brought in the courts of Naples, to decide the claims to which this singular confusion had given rise.

One of the most terrible earthquakes on record is that which happened at Lisbon on the 1st of November, 1755. The morning was fine, and there was no apparent indication of the coming destruction. About nine o'clock a low, subterraneous rumbling was heard, which gradually increased, and culminated, at last, in a violent shock of earthquake, which levelled to the ground many of the principal buildings of the place. Three other shocks followed in rapid succession, and continued the work of destruction. Scarcely had the ill-fated inhabitants begun to realise the enormity of the disaster which had come upon them, when they were surprised by another visitation, of a different but not less destructive character. The sea suddenly began to rush with great violence into the Tagus, which rose at once as much as forty feet above high water mark. The water swept over a great part of the city, and many of the inhabitants fled from its approach to take refuge on a strong marble quay lately erected. They had collected there to the number of 3,000, when the quay was suddenly hurled bottom upwards, and every soul on it perished. There was another shock in the evening which split the walls of several houses; but when it passed away, the rents closed up again so firmly that no trace of them could be seen. What the earthquake and the flood had spared was consumed by fire. The 1st of November, being All Saints' Day, was kept as a high festival, and all the churches were brilliantly illuminated with candles; these falling, with the shock of the earthquake, against the timbers and curtains, set fire to them, and as there were no means of checking it, the conflagration rapidly spread. It is stated that by the combined effects of these disasters, no less than 60,000 persons perished. The destructive effects of the earthquake were felt, more or less, throughout the whole of Portugal and a great portion of Spain.

At Cadiz the inhabitants were terrified by seeing the sea suddenly rise to the height of sixty feet above its ordinary level. It came on like a gigantic wall of water, advancing against the town, which it inundated, causing great destruction and considerable loss of life. It then retreated far out to sea, leaving a great part of the bay dry. This alternate rising and subsidence of the waters was repeated three or four times, each time abating something of its violence, until the sea at length resumed its usual level.

The earthquake which lately laid waste Iquique and the neighbouring places on the west coast of South America, presented many features strikingly similar to those of the Lisbon earthquake. There was the same terrible overthrow, without any previous warning; there was the same overwhelming rush of water from the sea. In the official report forwarded to the Admiralty it is mentioned that, 'Immediately after the earthquake it was noticed that the sea was unusually high; suddenly it receded with great rapidity, uncovering the bay at a depth of four fathoms. While the sea was going out, there was seen coming from the south-west, as if to meet it, a great wave. It is described as a dark blue mass of water, forty feet high, without crest or foam, rolling steadily on at the rate of about fourteen miles an hour. This, when it reached the land, surged over the town and neighbouring beach. The destruction was complete, and as the sea went off to its original bounds, everything in the lower part of the town was swept away.

The earthquake of Caraccas, in Venezuela, occurred on the 26th of March, 1812. The shocks continued at intervals, varying in intensity, till the 30th of April. In this earthquake 12,000 people are said to have perished. The same town was visited by another, almost as disastrous, in the year 1826.

Very violent earthquakes have been known on the table-land of Quito. In one which happened there, on the 4th of February, 1797, no less than 40,000 lives were lost. Not without reason did Humboldt say that there is no force known to exist, not even the murderous inventions of our own race contrived for each other's extirpation, by which, in the short period of a few seconds or minutes, such a number of persons can be killed, as by an earthquake.

Wonderful Statistics.

SIZE OF THE ATLANTIC WAVES.—From Dr. Scoresby's observations, made 1847-8, it appears that in a very heavy gale, the waves are from 24 to 36 feet high, or from 12 to 18 feet above and below the mean level of the sea. During a raging storm they have been 45 feet (22½ feet above and below). From crest to crest in a fresh sea, 100 to 150 feet; a moderate gale, 300 feet; a great storm, 600 feet, moving onward with a velocity exceeding 30 miles an hour.—*Companion to British Almanac for* 1858, p. 28.

CHARITIES OF LONDON.—The Registrar-General, in his Summary for 1856, mentions a startling fact —that, in that year, one person in every five that died closed his days under a roof provided by public law or private charity. Total number of those who died in 1856 in London, 56,786. Number of those who died in the same year in 116 public institutions—workhouses, hospitals, asylums, prisons, &c.—10,381.—*See Registrar-General's Returns, Annual Summary*, 1856.

BOOKS ON ARITHMETIC.—Professor de Morgan calculates that since the year 1500 there have been published 3,000 works on arithmetic, in Latin, French, German, Dutch, Italian, and English: an average production of one a year to each of these languages.—"*The Decimal System,*" *by Sir John Bowring*, p. 35.

A PLEASANT CLIMATE.—The following is the calendar of a Lapland or Siberian year:—June 23, snow melts; July 1, snow gone; July 9, fields quite green; July 17, plants at full growth; July 25, plants in full flower; August 2, fruits ripe; August 10, plants shed their seed; August 18, snow, continuing until June 23.

THE human brain contains a considerable proportion of phosphorus, varying from $\frac{1}{80}$th to $\frac{1}{50}$th of the whole mass. If the average weight of the English brain be taken at 47½ oz., it will then contain an amount of phosphorus amounting to $1\frac{1}{17}$ oz., or $2\frac{2}{5}$ oz. This phosphorus is found to be almost entirely wanting in the brains of idiots. The intellectual power of the human brain depends to some extent upon the depth and number of its convolutions. The lower we descend in the scale of intelligence, the fewer and shallower do these convolutions become. While the brain of the fox almost resembles a miniature human brain in its corrugated appearance, that of the pigeon is almost smooth.

THE voracity of the larvæ of insects is so great, that Linnæus has asserted that the progeny of three female flesh flies (each gives birth to 20,000 young, and a third generation is produced in a few days) would eat the carcase of a horse with greater speed than a lion. When first hatched, the larva of the silkworm weighs $\frac{1}{100}$th of a grain; previous to its assuming the pupa state it weighs ninety-five grains, an increase of 9,500 times its original weight. The full-grown caterpillar of the goat-moth weighs as much as 72,000 fresh born ones. If this proportion existed in the human race, and a fresh born baby weighed 10 lb., its mother would weigh 160 tons, 3 cwt., 2 qr., 27 lb.

A WONDERFUL VOYAGE.

RICHARD DEVOE.

THERE is a good story told of an American, who was rather given to drawing the long-bow, being paid back in his own coin by a still sharper American. The former was telling a wonderful story of how, on one occasion, having crossed the Atlantic, and nearing England, the captain of the vessel saw something coming towards them, nearer and nearer. There was much excitement on deck to know what it might be.

"And what do you think it was?" said the first American.

"Can't say," replied the other.

"It was a man who had come all the way from America on a hen-coop."

Says the other, "*I was that man.*"

The story of Richard Devoe recalls the anecdote above related, but it has the merit of being strictly true. This young sailor lad was miraculously preserved from the wreck of the schooner *Mary*, on her passage from Curaçoa to Greenock, in the year 1806.

It appears that on Saturday, 23rd August, 1806, the *Mary* experienced a tremendous gale, which continued all night. On Sunday it was calm for about two hours, when they made more sail, but the gale coming on they took in all but the foresail, under which they lay to, until suddenly the schooner upset. After remaining in the water in this situation for about a quarter of an hour they cut away the lanyards in hope that the vessel would right; but unfortunately she foundered while the captain was at the helm, and every soul but young Devoe and a man named William perished. Just before the vessel went down Devoe cut away the gripes of the long-boat, but in attempting to get into her she capsised; then, as a last resort, he swam to the booby-hatch, which he caught hold of. The sailor, William, got hold of the hatch at the same time, but, the sea upsetting it, he was obliged to let go his hold and was lost. Devoe continued by the hatch all night, holding on by the clamp when the fury of the gale abated. On Monday it was calm, and by a great piece of good fortune, à crab floated on to the hatch, which, from extreme hunger, he ate alive. Fatigued, cold, and almost exhausted, in this perilous situation he lay down on the hatch and slept. Having awoke, and feeling considerably refreshed, he saw two schooners

at a short distance, making, as he supposed, a S.E. course. He waved his hat and handkerchief, but there was no responsive sign. Early on Tuesday morning he saw a ship close by him, which he hailed, but those on board did not hear him, the current sweeping him away. The wind, however, suddenly turned and brought the ship so close to him that he was observed. A boat was immediately lowered, and Devoe was taken on board. She proved to be the *Rose Gardner* of Philadelphia, bound for Cork, but bearing away to New York in distress, where she arrived on 30th August.

Whilst Devoe was on the hatch his situation was rendered more terrible by observing the sharks devour the bodies of his dead comrades.

FIRE-BALLS.

ON the 7th of October in the year 1868, one of the most remarkable fire-balls of which any record exists, was seen from three points so far distant from each other as Paris, Rouen, and London. From ten to fifteen minutes before twelve, the moon and the stars shining brightly, the atmosphere being frosty and cloudless, and scarcely a breath of air stirring, thousands of people between and around the points mentioned above, were startled by a sudden blaze of light in the heavens. The brightness resembled that of the magnesium light, and not only did the moon and stars grow dim in its lustre, but many of the eye-witnesses were so dazzled by the glare, that they could not observe the phenomenon with sufficient accuracy to give any intelligible account of it. Others, with more presence of mind, have recorded their observations, and the result, from combining the various particulars they have given, is as follows.

A witness at Ramsgate relates that the meteor seemed to dart suddenly from the highest point in the heavens, and as it could not have been visible from places so wide apart as Paris and London, unless its elevation was very great, we may accept this observation as absolutely correct. As it floated slowly across the heavens (slowly when judged by the eye) in a direction from north to south, or more correctly, perhaps, from a point verging north-west to south-east, its appearance changed from that of an immense globe of white light to a comet-like form, the tail having various colours, changing from green through several shades of red to blue or purple. It exploded with a sound resembling two gunshots, audible at Paris and Rouen, but not, so far as we can learn, in any part of England. The probability is that it fell at La Varenne, St. Hilaire, near the Vincennes railway, and if so, it has been identified with a meteoric stone found in the grounds of M. Launy, and measuring about thirty-nine inches in length, by seven or eight inches in thickness.

History abounds in similar records, but it has not often been possible to combine the simultaneous observations made in distant places; and it may be doubted if the elevation would always admit of a fire-ball being observed at points so distant from each other as in this instance. It 1768, a cloud was seen to explode over the village of Lucé on the Maine, and the sound was heard ten miles distant. In 1798, a large fire-ball was seen near Benares, in India, and at several places, extending to a distance of fifteen miles. In 1803 a fiery globe of extraordinary brilliance was seen in full daylight over the town of L'Aigle, in Normandy, and at such an elevation that the inhabitants of two hamlets, a league distant from each other, saw it at the same time. It burst in a shower of meteoric stones.

To come to recent times, a great fire-ball was observed simultaneously on the 29th of April, 1865, at Manchester and Weston-super Mare. From the careful observations made by Messrs. Baxendale and Wood, Mr. Alexander Herschel was enabled to compute that this meteor first appeared exactly over the city of Lichfield, at a height of fifty-two miles; that it travelled at the rate of about twenty miles per second, and disappeared when at a height of thirty-seven miles, over the city of Oxford. Fire-balls are most often seen a day or two before, or a day or two after, the recognised dates of those wonderful displays of asteroids which are now known to be a regularly recurring phenomenon at two periods of the year. The probability is that all these appearances admit of one and the same explanation, namely, that they are masses of matter revolving round the sun, which come into contact with the earth, and take fire on entering its atmosphere. The smaller particles are consumed in passing through the atmosphere, and fall to the earth unperceived, as small dust; while the larger reach the ground in great masses, and often penetrate to a considerable depth.

The weight of some of these stones is well known. One which fell at Ensisheim in Alsace, on the 7th of November, 1492, weighed 260 lb., and sank itself three feet deep in the earth. Gassendi observed one fall on Mont Vasir, near Nice, on the 7th of November, 1627, which weighed 59 lb. In 672 two stones fell near Verona in Italy, the one weighing 300, the other 200 lb. Paul Lucas relates that when he was at Larissa, a town of Greece, near the Gulf of Salonica, a stone weighing 72 lb. fell in the vicinity. A shower of meteoric stones fell near Geneva in 1753, of which the largest weighed 20lb. In 1795 a stone fell in Yorkshire, within a few yards of one of the observers, and it was found to weigh 56 lb. Sometimes a large stone explodes into hundreds of small fragments,

SCENE ON THE FROZEN SEA.

and falls in a shower. It is even recorded that a fall of sand continued for fifteen hours over the Atlantic on the 6th of April, 1719, but this we should be inclined to attribute to the action of wind bringing clouds of sand from some desert region of the earth. Masses of iron and other materials, much larger than any we have mentioned above, are known to exist in places where their appearance can only be accounted for on the supposition that they are meteoric stones. One of these great masses, estimated at 70 cubic feet in bulk, is known to have fallen in America on the 5th of April, 1800.

When touched immediately after their descent, meteoric stones are invariably found to be hot. Sometimes they approach to the spherical in form, but are as often of irregular shape, as might be expected when an explosion has preceded their fall. They smell strongly of sulphur, and are generally covered with a black crust. They are by no means uncommon objects in collections of curiosities, and probably most of our readers have frequently examined them. A small one, about the size of a walnut, which the writer once possessed was spherical in shape, but with an irregular surface like a little potato; and it contained so much sulphur in combination with iron, that it gradually fell to pieces, and could even be crumbled by the finger. This gave an opportunity for observing that it was beautifully radiated from the centre, as if composed of myriads of fine fibres.

THE FROZEN SEA.

WHATEVER opinions may be entertained as to the existence of an open sea around the North Pole, it is agreed on all hands that there is a Polar Frozen Sea. In both the northern and southern high latitudes it has been found that there is a certain limit beyond which the progress of ships is barred by an impenetrable fence of ice. What is beyond it is more or less matter of speculation. Concerning the Frozen Sea of the Arctic regions, much more is known than has been ascertained about the Frozen Sea in the Antarctic circle; many more expeditions have been sent out to examine the nature of the sea around the North Pole than have ventured to the South; but it would appear that the latter is, of the two, the more impervious. Ocean surveyors, from the time of Cook to the time of Ross and Penny, have been unanimous in reporting that there is no indication of a break anywhere along the southern barrier. Their ships sailed for many degrees along the outer face of an icy wall, of which the first shelf was as high as their mainyard. Above and beyond that shelf, as far as the assisted sight could reach, there was nothing but solid ice, save in some few places, where what looked like land was joined on to and backed the frozen fringe. Mile after mile, day after day, the ships sailed on coastwise, keeping a pretty straight line of latitude, watching

narrowly for an opening in the hard ice cliff. Not any opening presented itself, and the results of discovery in the Antarctic regions have been to show that land, probably in continental proportions, does exist beyond the ice in some parts.

The frozen condition of the Arctic Ocean is a fact within the experience of every whaler, though the question of the extent to which the sea is frozen remains unsettled. At a degree of latitude which varies with the season of the year, the progress of ships northward is barred by a barrier of frozen water. During the summer months, when occasionally the thermometer will register a heat equal to the mean temperature of the tropics, and such life as there is in the Arctic circle wakes up and renews its lease, the zone of the north is loosened, the outer edge of the belt cracks and splits into vast mountains of ice which, becoming detached, get under way and start for the south. From the end of May they are to be met with in the North Atlantic, sailing majestically and dangerously towards those warmer regions of which the temperature is reduced and invigorated by their icy presence. The question is whether there is any general break up of the Frozen Sea, whether in the more northerly parts the pack ice ever becomes loose ice, and again whether, supposing it does not become loose, the pack ice drifts bodily southward as it has been suggested it does. Ships that have been nipped by the ice and have been surprised by winter in the north, report that during their captivity they have been carried many degrees to the southward by the drift of the pack in which they were enclosed. Lieutenant De Haven, of the American navy, when in command of the United States expedition after Sir John Franklin, was frozen up for nine months, at the beginning of which time he was in mid-channel in Wellington Straits, and at the end he found himself 1,000 miles to the southward. H.M.S. *Resolute*, which was abandoned by Captain Kellet in the ice, remained in the cold embrace of the ice nip for several years, but in the end was borne south till the temperature burst her bonds and she was recaptured and sent home unharmed. These instances only prove that the particular portion of the Frozen Sea in which the ships were bound became loose, though there is good reason to think that the entire belt of ice about the North Pole does in ordinarily warm summers become detached, new ice being formed on the extreme northerly limit of the sea as soon as winter returns, in order to replace what has been during the summer pushed away to the southward.

If we may credit the great amount of evidence which has been adduced, we should adopt the general belief of Arctic explorers, that beyond the Frozen Sea there is a large open sea, free from ice, which extends for several degrees all round the Pole. Dr. Kane, in one of his search expeditions, crossed a barrier of ice a hundred miles broad, of which the northern boundary was reached in the eighty-third degree of north latitude. There he found an open sea extending in an unbroken sheet of water as far as the eye could reach towards the Pole, the waves broke upon the shore, and there was a tidal variation in the height of the water, the temperature of which was four degrees above freezing. Whether this sea was only temporarily from ice or whether it is always open, is a yet to be solved. Explorers who have far to the northward of Dr. Kane's posi- ve reported the whole place ice-bound, with apparently an unmoving, fast-anchored ice-pack stretching away to the north.

Our illustration—taken from an original sketch made on the spot—gives a remarkably vivid representation of the rugged wildness of the Frozen Sea.

PROOFS OF GUILT

THE origin of the curious custom of making persons suspected of murder touch the murdered body for the discovery of their guilt or innocence is interesting. This method of finding out murderers was practised in Denmark by King Christian II. The story goes that it arose in the following way. Certain gentlemen being on an evening together in a tavern, fell out among themselves, and from words grew to blows, insomuch that one of them was stabbed with a poniard. Now the murderer was unknown, by reason of the number, although the person stabbed before death accused a pursuivant who was one of the company. The king, to find out the homicide, caused them all to come together, and, standing round the dead body, he commanded that they should, one after another, lay their right hands on the dead man's naked breast, swearing that they had not killed him. The gentlemen did so, and no sign appeared against them. The pursuivant alone remained, who, condemned before in his own conscience, went first of all and kissed the dead man's feet, but as soon as he laid his hand on his breast, the blood, we are told, gushed forth both out of his wound and his nostrils, so that, urged by this evident accusation, he confessed the murder, and was, by the king's own sentence, immediately beheaded.

The elder Disraeli, in his "Curiosities of Literature," gives several examples of these "ordeals," as they were called, such as walking blindfold amidst burning plough-shares; passing through fires; holding in the hand a red-hot bar; and plunging the arm into boiling water. The popular affirmation, "I will go through fire and water for my friend," was, in all probability, derived from this custom.

Disraeli says, "Those accused of robbery were put to trial by a piece of barley bread on which the mass had been said, which if they could not swallow, they were declared guilty. This mode of trial was improved by adding to the bread a slice of cheese, and such was the credulity that they were very particular in this holy bread and cheese, called the *corsned*. The bread was to be of unleavened barley, and the cheese made of ewes' milk in the month of May." Du Cange observes that the expression, "May this piece of bread choke me," comes from this custom.

Monetary Wonders.

JOINT-STOCK MANIA.—In Swift's Memoirs, Sir W. Scott states, that in 1720 most chimerical schemes were circulated in abundance, introducing a breed of asses, sweeping the streets, and maintaining foundlings; and one projector obtained subscriptions to a very large extent, and some advance in ready money on each, for a project, the object of which he declined to explain, further than by promising a return of the adventurers of cent. per cent. Swift wrote several papers abusing these projects.—*Swift's Memoirs*, p. 251.

MANIA FOR SPECULATION.—In 1720, the time of the South Sea Bubble, amongst the many mad schemes put forward, was one for "An undertaking *which shall in due time be revealed*." Each subscriber was to pay down two guineas, and there were actually 1,000 of these subscriptions paid in one morning, the promoter of the scheme decamping with the money the same afternoon.—*Lord Mahon's "Hist. Eng.,"* vol. ii., p. 12.

MONOPOLIES IN FRANCE, SEVENTEENTH CENTURY.—To such an extent was this practice carried that in 1677 the Duke of Bouillon, Grand Chamberlain of France, procured the privilege of selling a *poison for vermin*. Bills notifying the privilege were posted on the walls of Paris, and a copy is given in Locke's Journal.—*See "Life of Locke," by Lord King*, p. 86, Bohn, 1858.

THE WONDER OF THE TELEGRAPH.

II.—THE NEEDLE INSTRUMENT.

WE have described the recording instrument for transmitting messages, invented by Professor Morse, and improved successively by Mr. Bain and Mr. Allan. There is, however, a totally different method of signalling by means of what is called the needle instrument, invented by Messrs. Cooke and Wheatstone. This instrument flashes the intelligence as fast as it can be read off by the eye, following the motion of the needle as it points to the characters; but it makes no record of the messages. The clerk writes it down letter by letter as it is signalled.

Every one is familiar with the appearance of the dial of this apparatus, seen so frequently in private offices and in railway stations. To explain the action of the mechanism behind the dial we must refer to a phenomenon in electricity which we have not hitherto mentioned. If a magnetic needle (as used for the mariner's compass) be freely suspended in a direction parallel to the wire through which an electric current is directed, *the needle will place itself at right angles to the wire*. The reader must be contented with a bare statement of this fact: it is sufficient to enable him to draw the inference that just as an electric magnet can be made to attract its keeper by means of a current of electricity, and thus set other parts of the apparatus to which it belongs in motion, so a needle can be made to move in certain directions at the pleasure of the operator. This motion of the magnetic needle (which is concealed in the box behind the dial) is transferred mechanically to the needle on the outside, the quick movements of which look almost like intelligence. All the rest is only a matter of arrangement and manipulation. If the handle, *b* (Fig. 1), be moved to the right, the current of electricity moves the needle to the right, once, twice, or thrice as may be required to make the signs corresponding to the letters of the alphabet, and the same as regards the movement to the left.

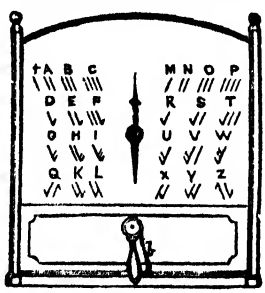


Fig. 1.

To explain this, a little attention will be required to the following diagram (Fig. 2, p. 72).

The reader must imagine himself to be standing so as to face the back of the dial. The boss, A, represents the end of the spindle worked by the handle in front of the instrument. When at rest, the position occupied by the rod, *c b*, is that of the dotted lines, *g h*, but the handle having been moved to the right the cross piece at the end of *c b* touches the spring D *d* at *d*, while the other extremity touches the spring E *e* at *e*. Now as the wires F *f* connect *c b* with the battery B, and as the wires I *i* are connected with the galvanometer,* C K (in which the

* A galvanometer is an instrument composed of a magnetic needle surrounded by a coil of wire, through which the electric current is passed. The length of wire coiled up increases (within certain l[illegible] the sensitiveness of the needle.

magnetic needle itself works), it is evident that by moving *c b* into the position represented, the disjoined parts have been brought into contact, and the *electric circuit* is completed.* The same result would have taken place if the handle in front of the instrument had been turned to the right, except that the current would have been reversed. Its action is as follows :—

The current of electricity derived from chemical action in the battery passes into the wire F, and thence to the distant station by way of W through the

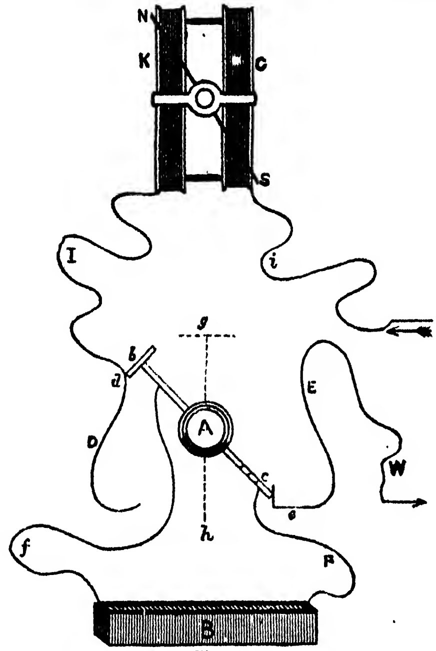


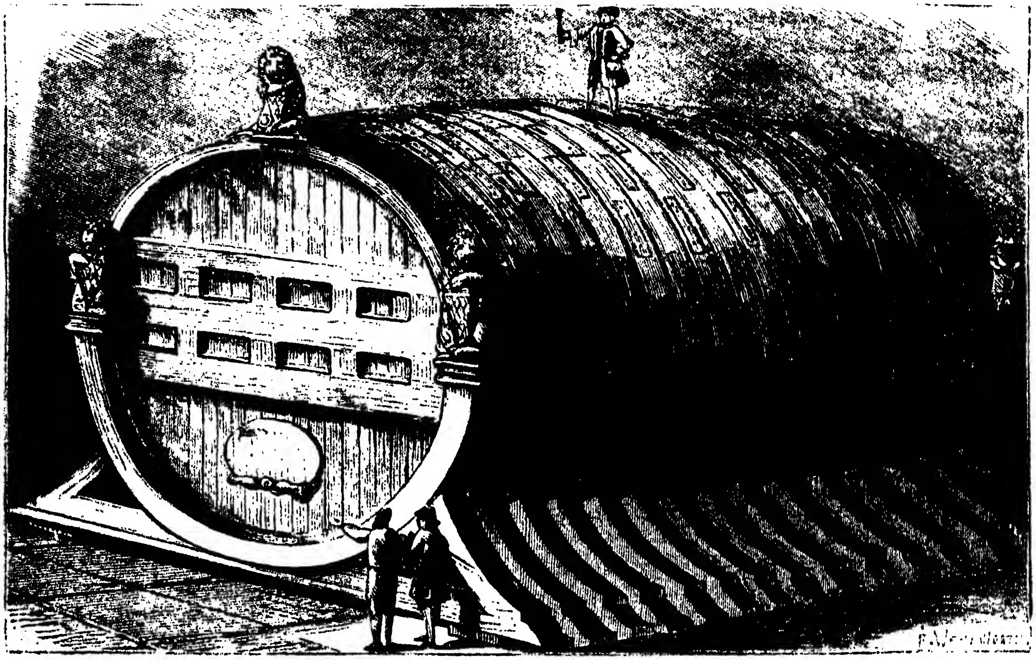
Fig. 2.

earth, where it deflects the needle. From the distant station it returns in the course marked by the arrow and passes through the wire *i* into the galvanometer coil C, and deflecting the needle, S N, returns to the battery through the coil K and the wire I. All this, though it takes long to describe, is effected instantaneously. The direction of the current is reversed according as contact is made at *d* or E, and the motion of the needle of course responds to it. For example, to telegraph the word CAN the movements must be four to the left, two to the left, and two to the right, as shown by the signs on the dial. If the needle be moved thus in London, and the other end of the conducting wire be in Edinburgh or elsewhere, the needle at that end also moves in the same way.

In estimating the velocity with which messages can be delivered by any of the instruments we have described, it must be remembered that there are mechanical arrangements to be taken into account. From observations made with the Atlantic cable, it has been proved that the electric current travels at the rate of 6,020 miles a second, and on land lines it is known to be considerably greater, the average of several experiments giving 16,000 miles per second. So far, therefore, as the natural law is concerned, "as quick as lightning" would express no more than the truth ; but when mechanism has to be moved, other laws come into operation which seriously affect the result. In his evidence before the select committee on the Electric Telegraphs Bill in the House of Commons, last year, Sir Charles Wheatstone affirmed that, ordinarily, from twenty to twenty-five words a minute are sent ; he produced an instrument, however, which is capable of sending from sixty to seventy words a minute, and which he affirmed has worked at the rate of one hundred and twenty. To send twenty-five words a minute by the ordinary Morse apparatus is a feat of dexterity, however, not practical work under ordinary circumstances. An exceptionally intelligent and skilful practitioner at each end of the wire must be provided, and after all the message may be as difficult to read by ordinary telegraph clerks, as bad handwriting by ordinary readers of print. The indentations are indistinct, or the dashes and dots blurred together. About fifteen words a minute, we believe, can be telegraphed with precision, and this rate of speed is equivalent to a hundred lines of our own printed columns per hour. This view of the case is supported by the following facts. On Saturday, December 21, 1867, a message of forty-eight words was sent from London to Washington in nine and a half minutes, the time of transmission being divided as follows : from London to Heart's Content, four and a half minutes ; from Heart's Content to Plaister Cove, one and a half minutes ; from Plaister Cove to New York, one and a half minutes. A reply of sixty words was returned in twenty minutes. On the same evening a message of twenty-two words was sent from London to Heart's Content, and in ten minutes a reply of twenty-four words was delivered in London. These being trials of skill, the best hands were employed, and extra precautions taken to ensure speed.

We may safely affirm that the telegraph is yet only in its infancy. To say nothing here of Mr. Allan's plan for a system that shall be as universal as the penny post, Sir Charles Wheatstone has designed what he calls a "Cryptograph," or mode of secret telegraphy. This instrument is employed by the police, and it was found particularly useful during the Fenian excitement. Any person using one of these instruments may employ his own cipher ; and had it been used for military purposes in America during the late war, the artful trick of "tapping" the telegraph wires, and misdirecting the troops of the enemy, or discovering their movements would have been impossible to execute.

* Various other mechanical arrangements are in use, but the principle is the same in all.



THE GREAT TUN

THE GREAT TUN OF HEIDELBERG.

Heidelberg was the capital of the Palatinate of the Rhine, from 1362 to 1719, when the Elector removed his residence to Mannheim. The magnificent castle, which stands on a commanding eminence, embosomed in dark woods, overlooking the town, was the palace of the Electors Palatine, and was celebrated during a part of this long interval, for two curiosities: first, the five stone pillars said to have been brought from Ravenna by Charlemagne; and secondly, the "Great Tun." In the year 1608, the city was visited by one Thomas Coryat; and Tom, as the traveller loves to call himself, being able to make use of the name of his friend Sir Henry Wotton, at that time ambassador at Venice, was admitted to some familiarity with the people of Prince Frederick's court, and so found his way into the wine-cellars of the castle. There he beheld a "wondrous company" of great wine-barrels, the sight of which, and something more, made him "spin," and he was at last taken into a room which contained a wonder not unworthy, in his estimation, to be classed with the Colossus of Rhodes, the hanging gardens of Semiramis, or the tomb of Mausolus. These "decantated miracles," Tom says, were no worthier of the immortality they have won than this miraculous wine-barrel.

Recent accounts state that the great tun was first constructed in 1343, when it was made to contain twenty-one pipes of wine; that it was succeeded by one made in 1664, which held 600 hogsheads; and that this again having been destroyed by the French in 1688, was succeeded by a third which held 800 hogsheads, and is now mouldering away, being no longer used. Tom Coryat says the miraculous tun seen and depicted by him was begun in 1589, and finished in 1591, seventeen years before his visit: "one Michael Warner, of the city of Landavia, being the principal maker of the worke." It contained nearly 600 hogsheads of Rhenish wine, valued at £2,000. It must not be supposed that the staves of this immense tun were like those of common wine-barrels. They were really great beams of wood, 27 feet long, and 112 in number. The diameter of the tun was from 16 to 18 feet, and the boards were hooped together with 26 iron bands, weighing 11,000 pounds. The supports of this huge mass were "marvellous great pillars made of timber, and beautified about the ends and the top with the images of lions," which are the arms of the Electors Palatine: Three lions were at each end, "a fair scutcheon being affixed to each image." It is this tun that our illustration represents. According to Murray's Handbook, the existing tun was made in 1751, and it has not been used since 1769. It is capable of containing 800 hogsheads, or 283,200 bottles. No wonder it is

disused, for its predecessor, the tun of 600 hogsheads, was once emptied in eight days by the Elector's gallant visitors.

Heidelberg Castle, bearing on its shattered walls the marks of the devastating fury of the savage Louvois, is at the present day one of the most picturesque ruins in the world. In one of the cellars may still be seen the great tun, more marvellous in point of size than that which Coryat saw; but the traveller has no longer any need of honest Tom's caution, not to be over-persuaded by the social Germans—at least, while he stands on the top of the barrel—to take too much of the good Rhenish which it contains no longer.

SIR EDWARD MORGAN, THE JAMAICA BUCCANEER.

It is not at all wonderful that there should be pirates by profession; but it does seem wonderful that there should have been professional pirates who not only justified their acts to themselves, but found quiet, steady-going folk to sympathise with them, and even to help them in their enterprises. Yet so it was. In the Elizabethan days, when the Spanish power was dominant and domineering, when might was right, and men went upon the good old rule—

> "The simple plan
> That they may get who had the power,
> And they may keep who can,"

there was a perpetual succession of men who risked their lives, their property, and their honour in adventurous voyages which had for their object the enriching of the voyagers at the expense of the regular commerce of the dominant Spanish power. It did not suit the public convenience of most of the European states to be at open issue with the greatest power of the Continent, with which, however, there could never be any abiding peace; so private wars, undertaken at private cost and private risk, involving the country in no responsibility, nor in any difficulty in case of the voyagers being captured, were winked at, if not directly countenanced; and if the bold adventurers could get rich in the war, so much the better for them. Of this class of adventurers were Sir Walter Raleigh, Sir Richard Grenville, Martin Frobisher, Hawkins, Drake, and many more whose names are foremost in the roll of glory which belongs to Elizabeth's reign. But there was a class of persons who quickly followed the evil part of the example of those who did evil that good might come—men whose sole delight was in doing mischief that they might suck no small advantage out of the confusion their own wickedness had caused.

Among these buccaneers, as they were called, were men whose wonderful success has almost raised them to the rank of heroes. "No one doubts the nobility of conquerors," and conquerors some of these undoubtedly were. With their hand against every man and every man's hand against them, it is marvellous that any of them should have survived more than a few years of their wild life, exposed as they were, not only to the vengeance of man, but to the manifold perils of a sickly climate, and the dangers of a notoriously stormy region. Many sea-robbers went down into Hades, sent thither by the sword of successful resistance, or strangled by the rope of justice's executioner; but some of them survived all the horrors of their life, and became decent members of society. Edward Morgan was one of these. He was of the family of the Morgans of Tredegar, and, being obliged to leave home, went to Jamaica, the head-quarters of the buccaneers, and offered his services. Soon he rose to command a ship, and the other pirates, finding him so able a man, preferred to be of his company rather than of any other. He was brave, skilful, and energetic, fertile in stratagem, and with a presence that inspired respect in those who placed themselves under his command. He had, moreover, that cold, hard nature, which did not shrink from deeds of horror, which was dead to all considerations of pity, and which was eminently suited to the leader of a band of robbers.

Morgan was in the habit of organising regular warlike expeditions, of which the fitting out and the dispatch were openly announced at Jamaica, and winked at by the governor, probably "for a consideration." In conjunction with Mansfeldt, the prince of pirates, he stormed and plundered Providence Island, thirty-five leagues from Chagres River; and in 1668 went in chief command, with nine ships and some five hundred men, against the Spanish settlement of Porto Bello. This place he approached by night, surprised the sentries, and carried the castle; and, shutting up all his prisoners in a dungeon, fired the magazine, giving as his reason for this horrible cruelty that he could not spare enough men to guard the captives. The commandant of the town retired into the remaining fort, and kept up an incessant cannonade upon the pirates, who, however, made only the more haste to kill, burn, and destroy. They forced the people of the place to help them to rear their scaling ladders against the fort, and when they got possession they slew the garrison partly by way of revenge, partly as a terror to others. For fifteen days they remained at Porto Bello, indulging in the utmost licence and brutality. They then sailed away with 250,000 pieces of eight (a piece of eight was worth about five shillings) and an enormous amount of plunder—a quantity so vast that on the sea-shore at Jamaica the plate, jewels, and merchandise which had been stolen from churches, colleges, and houses at Porto Bello were literally piled up under the eaves of the houses for want of warehouse room. This great prize was soon spent in debauchery and riotous living, and in a few weeks Morgan put to

sea again at the head of a thousand desperadoes. Maracaibo and several other places on the Spanish main were visited with all the horrors of a buccaneer attack; and Panama, a strongly fortified place, and the depôt for much of the wealth of the Spanish West Indies, was captured after a fight in which quarter seemed to be excluded from the conditions. Somehow or other, a fire broke out, which could not be extinguished, and kept on burning for several days. Molten gold and silver was found encrusted on the pavements of the streets, and into the cellars and wells of the city many millions' worth of valuables were thrown in hope of hiding them from the greedy captors. Notwithstanding the loss of large quantities of plunder, Morgan arrived at Chagres with 175 mules laden with gold and jewels. At Chagres he divided the spoil, but his men accused him of cheating, and mutinied, driving him off with two or three ships and 400,000 pieces of eight to Jamaica.

On returning from this voyage, Morgan determined, like Falstaff, "to live cleanly, as a gentleman should." He bought an estate, turned planter, and so conducted himself in Jamaica, that Charles II. conferred on him the honour of knighthood, and made him governor of the island. The accounts vary as to his end; some say he lived to a good age, and died respected and beloved in his adopted country; others, that he was ordered to England to take his trial for some piratical acts he had committed after he was made governor, and that he died in disgrace and in comparative poverty.

Morgan, or rather Sir Edward Morgan, was a fair specimen of the better sort of buccaneer. Of the scoundrels who did worse, it were long to write, and the account would read like a passage out of the annals of hell. It required many years, and the exercise of an immense amount of force, to clear the West Indian seas of these dreadful scourges; and the execution of the last of the buccaneers is an event of quite modern times. In Morgan's time the Government winked at what was done. Witness a letter from Lord Arlington, Secretary of State in 1665, to Sir Thomas Modyford, governor of Jamaica, directing him that "privateers be handled quietly for the future, and be reclaimed by degrees;" and in 1664 it was officially stated that the calling in of the privateers was "a remote and hazardous experiment."

CURIOUS ORIGIN OF THE NUMERALS V, X, C, L, M, D.

THE writer of this is not aware whether Pasquier's ingenious mode of accounting for the origin of the above numerals has ever been superseded by a more plausible theory. If not, the suggestion is at least interesting.

The earliest method of reckoning is universally believed to have been with the fingers. Each finger would stand for one, and would be representable by an upright stroke, so that the number four was originally IIII. To continue the account, the number five was considered to be formed by the first finger and thumb when displayed, which it will be seen has something of a V-like figure. The representation of five being thus fixed on, that of ten would be determined by uniting two fives - that is, two V's by their apices.

The letter C—anciently written Ľ, being the initial of the Latin word *centum*, a hundred—was a very obvious abbreviation of that number, and being divided in two, horizontally, each half was a kind of L; that letter, therefore, was adopted to signify fifty. The letter M was the initial of *mille*, a thousand, and being anciently written thus, ⅭⅠↃ, the half of it bore a near enough resemblance to a D, to suggest the adoption of that letter for 500.

Instead of the four strokes, we now use IV. for four, signifying five less one; six is VI., signifying five plus one; seven and eight follow the same rule; nine is IX., signifying ten less one; eleven is XI., or ten plus one. The rest are obvious.

THE MINER'S CORPSE AT FAHLUN.

From Schubert's "Night-side of Natural Science," 1818.

IN the Swedish mines of Fahlun, while making a cross excavation between the shafts, some workmen discovered a corpse, so saturated with the vitriol, which is found in iron-mines, as to become, when brought into the air, as hard as stone, though perfectly soft when first touched. For fifty years had the body lain three hundred feet below the surface of the ground in a pool of vitriol; and no one would have recognised the unaltered features of the unfortunate young man, no one would have remembered the circumstance of his having been lost (traditions of the neighbourhood becoming confused, owing to the melancholy frequency of such accidents), had not the heart of a faithful woman identified the once beloved face. For when the inhabitants of the neighbourhood, full of eager curiosity, were pressing round to gaze on the recovered corpse, an aged grey-haired female, leaning on crutches, came up, weeping, to the body, affirming it to be that of her betrothed husband, and blessing God for the day on which the gates of the grave had opened, to enable her to look on him once more. The bystanders beheld with astonishment the re-union of this singular pair, of whom one had retained his youthful appearance in death and in the bowels of the earth, while in the other the warm love of youth had remained true and unaltered, amidst the decay of her beauty and the inroads of old age upon her wasted exterior.

CORAL ANIMALS.

—o—

WONDERFUL in themselves, wonderful in their operations, are those multitudinous, minute contractors, who undertake the business of building up "continents to be," and causing the dry land to appear in the midst of the world's oceans. They may be seen by those who seek them, in the waters of warm climates, incessantly at work a few fathoms, it may be a few feet, below the surface, waving about like an under-water fringe that borders the garment of some great rock. In the clear blue water of the tropics their operations may be watched and their habits studied, with a facility altogether exceptional. Notwithstanding, it was for many years questioned whether they belonged to the vegetable or animal kingdom, and it was not till the middle of the last century that their true nature was ascertained. They are animals having a low form of life, and dwell in houses of their own building; they are divided into many families, each family having its own characteristic style of architecture, and being celebrated for some special kind of building. The work of some is rough and massive, that of others polished and elegant; all their works are beautiful, and they are accomplished with an industry that is untiring, and a devotion which is even unto death.

Fig. 1.—PORITES AND

Coral animals are polyps, having an intestinal cavity, with distinct mouth surrounded by radiating lobes. They secrete salts which are over and above the wants of the sea in which they live, and with these salts, prepared by them in some wonderful way, they construct those blocks of solid masonry which are known as coral reefs, coral barriers and fringes, and coral islands. These reefs are indeed but a collection of corals' houses, so many coralline cities. The coral animals, being gregarious, live and work together, joining house to house, and street to street, till the aggregate comes to be an important geographical item. When dead, they leave their bodies in the house where they lived, and that be-

coming filled up, forms a strong stony foundation, on which a new generation can build a fresh superstructure. The corals' village, or polypary, as it is called, seems itself to be endowed with vitality, and to be so intimately connected with the being of the polyps who dwell in it, that it is questionable if they could exist apart from it. Upon the polypary, wherein already several generations lie buried, there is seen a swelling, the top of which in course of time cracks across, and thereout comes the new corallium. It is in this way that the creatures are perpetuated. The new corallium inhabits the cell from which he was born, and having done his work, makes his grave there, as his forefathers did before him.

Fig. 2.

It has been ascertained that the coral animals cannot live at a greater depth than thirty fathoms below the surface. From that depth they will build gradually up till they come in contact with the atmospheric air, or until their path is crossed by some fresh-water affluent. In either of these events they die, leaving their work to be continued in a lateral direction by their surviving kinsmen, and to be upheaved into space in the shape of a reef or an island; or to be broken off by the sea waves, which pile it up in boulders. The number of coral animals required to make a given piece of work varies greatly according to the family of the creatures, and the class of work to be done. In a piece of *Astræa* polypary, twelve feet in diameter, it has been reckoned that there are 100,000 coral animals, and that in a polypary of the *Porites* family (Fig. 1.), of the same diameter, there are five millions and a half. The progress of the builders is slow, a few inches only of masonry being added in the year; but then what masonry it is, how superbly strong and how firmly bound together! It is all piece-work—none of it is scamped; the lord of creation may examine it never so closely, he must ever admit that it is very good.

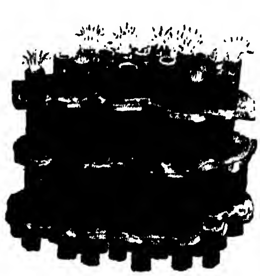


Fig. 1.

The madrepore family undertake the largest ocean works; their polypary is the well-known tree coral, which, branching out in all directions, the little camellia-like blossoms on its branches, looks like some beautiful, white sea plant in the garden of Neptune. Sometimes the madrepores build fans, sometimes vast, shapeless masses of work; their style includes several forms of architecture, and they are, super-eminently, the great general contractors among the *travailleurs de la mer*.

coral family, which works in long tubes. The drawing shows the polypary of the *Tubipora musica*, or organ coral, so called from the tubes of which the polypary is composed being ranged side by side like the tubes in the organ. This is not a common coral, though it may be found in most tropical waters, generally in a more sheltered position than the madrepores choose for their operations. Then there is the well-known blood coral, of which we give an illustration in Fig. 2, which grows only in the Mediterranean, and especially about the island of Sicily, and is the work of the family *Corticata*, or barked corals. These creatures have a stony axis, covered with a soft fleshy bark, in which are embedded little spicules of limestone, and polyp cells dotted all over it. This polypary is fixed on to some hard substance on which it slowly grows. Its form and colour are well known, for it is from this coral that bracelets, necklaces, and other coral ornaments are made. The polypary, as imported, has grooves on its surface running fore and aft, these having formed channels of communication for the polyps during their residence. This coral is of slow growth, and never attains to any size, a specimen a foot in length being considered good. It is found at a depth below the surface, in retired places, and the seeking of it affords employment to many hundreds of people.

A very simple mode of obtaining it is adopted off the coast of Sicily: a large cross of wood heavily weighted is let down into the sea, with a net at each end, this apparatus being dragged over the coral beds, breaks off large pieces of coral, which get entangled in the nets, and are thus secured.

There are many other families of coral animals, but their history would be long to tell. The wonder attaching to one attaches to all, and it is rather with that than with the natural history of the creatures that we have now to do. All alike bear witness to the wisdom of Him who created them, and who in their case, as in the case of babes and sucklings, has ordained strength out of weakness. They with all His works praise Him.

Wonders of the Microscope.

RECENT MICROSCOPIC RESULTS.—By a microscopic examination of the retina and optic nerve of the brain, M. Bauer has found them to consist of globules of $\frac{1}{2800}$th to $\frac{1}{2000}$th of an inch diameter, united by a transparent fluid. The achromatic microscope shows the hair to be indented with teeth resembling those of a coarse round rasp, but extremely irregular and rugged. And these incline all in one direction, from the origin of the hair towards its extremity; so that if a hair be drawn between the finger and thumb from the end to the root, it will be distinctly felt to give a greater resistance and a different sensation to that which is experienced when drawn the opposite way. By the aid of the microscope, shells can be measured to the thousandth part of an inch. Crystals can be obtained from an imponderable quantity of a substance, and those so characteristic that poisons can be thus detected when the substance for examination is too small to be submitted to tests. Sir David Brewster has detected, with a microscope, a fine down of quartz the filaments of which could not exceed the *one-third of a millionth part of an inch.* Professor Kelland has shown in Paris, on a spot no larger than the head of a small pin, by means of powerful microscopes, a specimen of distinct and beautiful writing, containing the whole of the Lord's Prayer written within this minute compass. The microscope detects the invisible ingredients which adulterate our food, our drink, and our medicines. It tells the murderer that the blood which stains him is that of his brother, and not of the other life which he pretends to have taken; and, as a witness against the criminal, it, on one occasion, appealed to the very sand on which he trod at midnight. Hundreds of adulterations have been discovered, the detection of which was beyond the power of chemistry. Three distinguished chemists are known to have asserted it was impossible to detect the presence of chicory in coffee; whereas, by the use of the microscope, the differences of structure in the two substances can be promptly discerned, no matter to what extent they may be pulverised, mixed, or even roasted. Professor Sorby's microscope detects the most minute stains; even of the millionth part of a grain we can have the most perfect view. And by the microscope it has been found that in certain Bohemian schists there are fifty-one millions of animalcules to the cubic inch, each skeleton weighing no more than the two hundred millionth part of a grain.

THE MOST PERFECT MICROSCOPE.—In 1864, an eminent microscopist expressed his conviction that in the production of object-glasses with one-twenty-fifth of an inch focus, the microscope had reached its utmost attainable limit of perfection. He added that "it appears impossible to separate or define lines more numerous than 90,000 in an inch, on account either of the decomposition of light, or some other cause. It, therefore, seems beyond our power ever to discover more of the ultimate composition of bodies by means of the microscope." Yet, an object-glass, with a one-fiftieth of an inch focus, has since been made by Powell and Lealand. This object-glass possesses *double* the power of the above, and defines with wonderful distinctness particles which the latter cannot render visible at all. It magnifies 3,000 diameters with the low eye-piece; or with a No. 5 eye-piece, 15,000 diameters—that is to say, in popular parlance, 1,575,000,000 of times. It must immensely increase our knowledge of the lower organisms, and may even aid our researches into the ultimate constitution of matter.

THE PHILOSOPHER'S STONE.

IN the opinion of the alchemists, or those who practised the pretended art of making gold and silver, all the metals are compound, the bases of them containing the same constituents of gold, but mixed with various impurities, which, being removed, the common metals were thought to assume the properties of gold. The change was said to be effected by what was called the "Philosopher's Stone," which is described as a red powder, with a peculiar smell. It was prepared by adding to the mercury of the adepts, philosophical gold, which, being left in a brooding furnace, becomes a black substance, then a white body, and being long and more fiercely heated, becomes yellow, and, finally, bright red. Now, the Stone so prepared could hardly have been anything but an amalgam of gold, which, if projected into melted lead or tin, and then cupellated (purified), would leave all the gold that existed previously in the amalgam. It might, therefore, have been employed by impostors to persuade the ignorant that it was merely the Philosopher's Stone; but the alchemists who prepared the amalgam could not be ignorant that it contained gold. Yet, although the existence of the Stone was regarded for centuries as a fact, no one pretended to possess it; each adept only maintaining that it was in the possession of another. Roger Bacon, the "Friar Bacon" of the story books, believed in the production of the Philosopher's Stone; and Arnold de Villeneuve professed that he could increase the Stone at pleasure. In 1455, Henry VI. granted patents and commissions to find out the Philosopher's Stone, "to enable the king to pay all the debts of the crown in real gold and silver." No gold, of course, was ever made, but the king had a forge or smithy built for practice in Pall

Mall, on the site of the first Carlton House. Ripley, the alchemist, wrote on "the twelve gates" leading to the discovery of the Stone in 1470, but he repented his wasted life, and begged all men would burn his books, which were "false and vain." Basil Valentine, the German monk, was of opinion that the metals were compounds of salt, sulphur, and mercury, and that the Philosopher's Stone was composed of the same ingredients. Cornelius Agrippa joined the French alchemists in searching for the Stone, as did Paracelsus in his youth, but he died in poverty when young. Dee and Kelly sought for the stones. Boyle and Sir Isaac Newton joined in a process for "multiplying gold," for which a company was established in London. Leibnitz joined a society of Rosicrucians in Nuremburg, in the pursuit of the Philosopher's Stone. Bergmann, the chemist, relates a number of cases in which gold was supposed to be formed by the use of the Philosopher's Stone; though they were the result of fraud by secretly introducing into the crucible gold, pretended to have been obtained by transmutation. Sometimes crucibles were made with a false bottom, gold or silver being concealed at the real bottom; when, heat being applied, the false bottom disappeared and the gold or silver was found at the bottom of the crucible. Sometimes gold or silver were introduced in charcoal—the hole stopped with wax—or in the hollow rods with which the crucible was stirred, the end being closed with wax. A common exhibition was to dip nails into a liquid, and take them out half converted into gold. These nails were one-half gold and one-half iron, the gold being covered with something to conceal its colour, which the liquid removed. Roger Bacon believed the Stone sufficed to transmute a million parts—according to Raymond Lulle, a thousand billions of parts—of a base metal into gold. Basil Valentine states its power at only seventy parts; and Dr. Price, the last alchemist, only thirty to sixty parts of the base metal into gold. There lived at Wilton, in Aubrey's time, "a great chemist," who had spent his fortune in long search for the Stone:—"After his death," says Aubrey, "they found in his laboratory there two or three baskets of *egg-shells*, which, I remember, Geber saith is a principal ingredient of that Stone." Ashmole, the antiquary, tells us that, in 1653, "Father Backhouse" told him in syllables the true matter of the Philosopher's Stone, which he bequeathed to him.

Lady Mary Wortley Montagu, in a letter dated January, 1717, records that "at Vienna there was a prodigious number of alchemists. The Philosopher's Stone is the great object of zeal and science; and those who have more reading and capacity than the vulgar, have transported their superstition (shall I call it?) or fanaticism from religion to chemistry. This pestilential passion has already ruined several great houses. There is scarcely a man of opulence or fashion that has not an alchemist in his service; and even the emperor is supposed to be no enemy to this folly in secret, though he has pretended to discourage it in public." Nevertheless, some benefits have accrued to mankind from the ancient practice of an art which is now considered a low delusion and imposture. The books of the alchemists show the effects of experiments; and though they were guided by false views, they made most useful researches, and thus laid the foundation of experimental science and modern chemistry. Two centuries ago, Sir Thomas Browne regarded alchemical studies as the *cradle of chemistry*.

Wonders of Natural History.

The Dodo.—The dodo is one of the curiosities of natural history, on account of the entire extinction of the bird, and the paucity of its remains. Till a short time ago, nothing but a few fragments of its bones, and those scattered through several museums, were known to exist. In November, 1866, however, a collection of bones, discovered in the island of Mauritius, was received by Professor Owen. These comprised no fewer than a hundred bones and fragments, which had apparently belonged to four or five dodoes, somewhat differing from each other in size. The dodo was undoubtedly a pigeon, but it was flightless, and its structure was modified in conformity with this circumstance. It was somewhat larger than a turkey-cock, and the above discoveries completely authenticates the well-known portrait of the dodo, which hangs in the British Museum. It was addicted, in some measure, to animal food, and it was doubtless this fact that made its flesh less palatable to the Dutch settlers of the sixteenth and seventeenth centuries, than they found that of the pigeon. Sir Thomas Browne speaks of a specimen of the dodo exhibited in a show; he adds, that its keeper used to point out a heap of pebbles, some of which were as large as nutmegs, and which, he said, the creature ate.

Fecundity of Life in the Sea.—Schleiden, in speaking of the prodigious fecundity of aquarian life, says: "We marvel at the hen, which will lay 200 eggs in the year, but the eggs of a fish must be counted by hundreds of thousands. In every mouthful, the whale swallows thousands of the tiny mollusc, *Clio borealis*, which forms its chief nourishment. Frequently on the coast of Greenland, the sea is coloured for ten or fifteen miles in breadth, and 150 to 200 miles in length, with tiny Medusæ. A single cubic foot contains 110,592 of these animals, and such a streak of colour must contain at least 1,600,000,000,000 of them!" Among specimens of the animal and vegetable life at the

bottom of the Atlantic Ocean, in soundings along the telegraph plateau, were found *Foraminifera*—beings which secrete many chambered shells, each the habitation of a group of individuals so minute as to require the highest powers of the microscope to perceive them.

Effects of Frost.

When water solidifies, or freezes, it expands, and for this reason water-jugs and bottles, as well as the leaden supply-pipes, are often broken in severe weather by the formation of ice within them. The explanation of this is as follows. The water in the vessel freezes at the top, *a b*. No injury is done because there is nothing to hinder the expansion upwards. But if it freezes again to the depth of *c d*, until the ice becomes so thick that it is more capable of resisting the expansive force than the glass or earthenware of which the vessel is composed, the latter will break. As an illustration of the greatness of this expansive force, we borrow the following facts from Cazin's "Treatise on Heat," recently translated from the French by E. Rich.

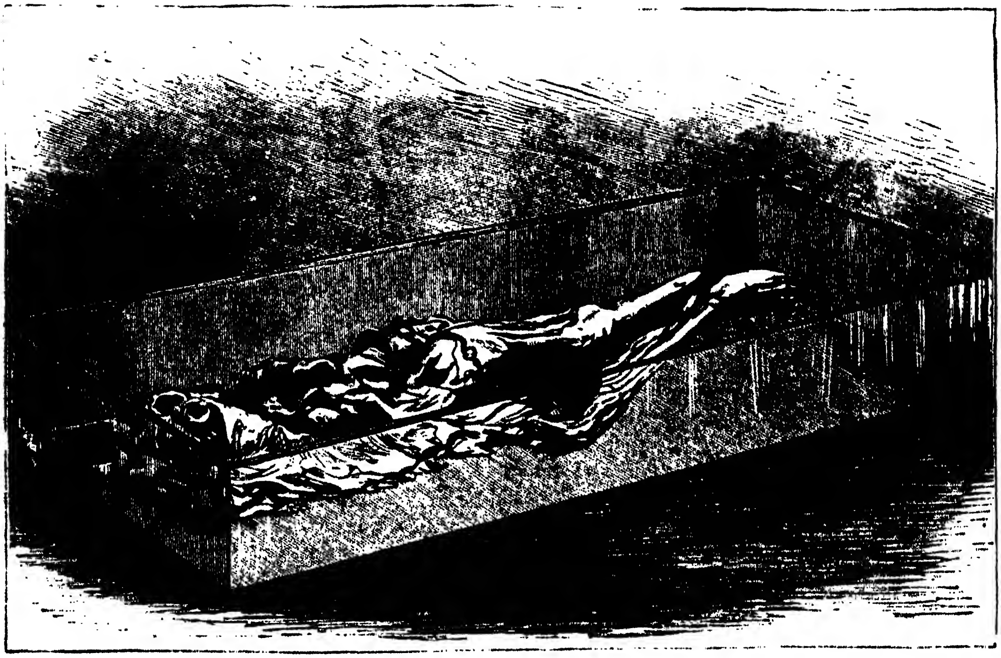
An artillery officer at Quebec made an experiment during a hard winter, by filling a bomb-shell, about fourteen inches in diameter, with water, and then closing the opening with an iron peg, which was driven firmly in. This being exposed to the severe frost, the stopper was driven out to a distance of more than 100 yards, and a cylinder of ice, eight or nine inches long, came out of the opening. In a second experiment of the same kind, the stopper resisted the expansive force; but the shell itself was rent, and a ring of ice was forced through the crack all round the shell.

In the same manner houses have been overthrown by the expansive force of frost in the earth causing the ground to swell up. Stones will break in consequence of the water they contain freezing, and trees have split up with an explosive sound on occasions of sudden cold occurring when their vessels have been full of sap.

An interesting experiment on the expansion of ice, was made by the Rev. Frederick Gardiner, and communicated to the American *Journal of Science*, vol. xl., 1865. The Kennebec River, near the town of Gardiner, is about 700 feet wide; the water is very fresh for many miles below, and the average ebb and flow of the tide is five feet; the depth of the water varies, according to the locality and state of the tide, from seventeen to twenty-five feet. In the course of the winter, the ice is always observed to crowd ashore, crumpling up in ridges on the flats, and near the edge of the channel. This process was well advanced when Mr. Gardiner commenced his experiment on the 6th of February. A row of stakes was planted in the ice, by boring holes through to the water, at distances of about 100 feet apart, avoiding a very near approach to the shore. The distance between the eastern and western stakes was 500 feet. On March the 18th, it was found that the easternmost stake had advanced 12⅝ inches, and the westernmost stake 12⅛ feet, making a total expansion of the ice between a distance of 500 feet, not less than 13 feet 2⅝ inches in forty days.

Leeches in Ice.—The common leech is said to be capable of resisting the effects of a low temperature to a wonderful degree. It is said that once a group of these animals left accidentally in a closet without a fire, during the severe frost of the year 1816, not only survived, but seemed to have experienced no injury, although they had been embedded in a solid mass of ice for many days.—*Howard on Climate.*

Preservative Properties of Frost.—Dr. Scoresby the celebrated Arctic traveller, states that all animal substances, fish excepted, may be preserved in Greenland for any length of time without being smoked, dried, or salted. Beef, mutton, pork, and fowls, the latter neither plucked nor drawn, are constantly taken out from the northern islands of Scotland, and preserved in this way. When used, the beef is divided by a saw; it is then thawed in cold water, and, if cooked when it is three, four, or five months old, will frequently appear as profuse of gravy as if it had been recently killed. A further antiseptical effect is produced by the cold on animal and vegetable substances, so as to preserve them, if they remain in the same climate, unchanged for many years. Wood has been met with in Spitzbergen which has resisted all injury from the weather during the lapse of a century. A French writer quoted by Dr. Scoresby relates, also, that the bodies of seven Dutch seamen, who perished in Spitzbergen in 1635, were found twenty years afterwards by some sailors who happened to land about the place where they were interred, in a perfect state, not having suffered the smallest degree of putrefaction.



THE OLDEST HUMAN RELIC IN THE WORLD.

Wonderful Relics.

THE OLDEST HUMAN RELIC IN THE WORLD.

In the Etruscan Vase Room at the British Museum is to be seen the skeleton of one Pharaoh Mykerinus, decently encased in its original burial-clothes, and surrounded by fragments of the coffin, whereon the name of its occupant can be easily read by Egyptologists, affording conclusive evidence that it once contained the mummy of a king who was reigning in Egypt *more than a century before the time of Abraham.* The proof is thus explained in the *Gentleman's Magazine*, April, 1866. About two years ago, Herr Dümichen, a German explorer of the monuments of Egypt, following up the indications pointed out by M. Mariette, a distinguished archæologist, discovered on the buried walls of the temple of Osiris, Abydos, a large tablet containing the names of the ancient Pharaohs from the time of Mizraim—the grandson of Noah, and founder of the Egyptian monarchy—to that of Pharaoh Seti I., the father of the well-known Rameses the Great, including thereby the chronology of nine centuries—viz., from B.C. 2300 to B.C. 1400. This tablet, by far the most important yet discovered, has been compared to the sculptured figures of the kings of England, at the Crystal Palace, from William the Conqueror to Her Majesty Queen Victoria. Astronomical evidence, moreover, enables us to determine the time of two important epochs in the history of Egypt, one of which is connected with our present subject. Sir John Herschel has fixed the age of the Great Pyramid of Ghizeh to the middle of the twenty-second century B.C. The tablet of Abydos shows that the Pharaoh whose bones we now possess succeeded the builder of the Great Pyramid with only two intervening kings. We are, therefore, warranted in assuming that the remains of Pharaoh Mykerinus belong to the age to which we have assigned them.

Egyptian Bricks.—The bricks of Egypt are among the most interesting relics of antiquity, preserved, as it seems, in an imperishable form. Professor Unger has examined a brick from the pyramid of Dashour, which dates from between 3400 and 3300 B.C., and has found embedded among the Nile mud or slime, chopped straw, and sand of which it is composed, remains of animal and vegetable forms, and of the manufacturing arts, entirely unchanged. So perfectly, indeed, have they been preserved in the compact substance of the brick, that little or no difficulty is experienced in identifying them. By this discovery we are made acquainted with wild and cultivated plants, which were growing in the pyramid-building days; with fresh water shells, fishes, remains of insects, and so forth; and a swarm of organic bodies, which, for the most part, are represented without altera-

tion, in Egypt at the present time. Besides two sorts of grain—wheat and barley—were found the field pea and the common flax, the latter having, in all probability, been cultivated as an article of food, as well as for spinning. The relics of manufacture consist of fragments of burnt tiles, of pottery, and a small piece of twine, spun of flax and sheep's-wool, significant of the advance which civilisation had made more than 5,000 years ago. The presence of the chopped straw confirms the account of brickmaking as given in Exodus and by Herodotus.

Wonders of Humanity.

JOSEPH CLARK, THE EXTRAORDINARY POSTURE-MAKER.—Joseph Clark, of Pall Mall, was undoubtedly the most extraordinary posture-maker that ever existed. Though a well-made man, and rather gross than thin, we learn from Caulfield's "Memoirs" that he exhibited in a most natural manner almost every species of deformity and dislocation. He frequently made himself merry with the tailors, often sending for one of them to take his measure, but so contriving as to have an immoderate rising on one of his shoulders. When his clothes were brought home and tried upon him, the deformity was removed to the other shoulder; upon which the tailor begged pardon for the mistake, and mended it as fast as he could. But upon a third trial he was found with perfectly straight shoulders and a hump on his back. He dislocated the vertebræ of his back and other parts of his body in such a manner that Molins, the famous surgeon, before whom he appeared as a patient, was shocked at the sight, and would not attempt a cure. He often passed for a cripple with persons with whom he had been in company but a few minutes before. Upon these occasions he would not only change the position of his limbs, but entirely alter his countenance. His facial powers were more extraordinary than his flexible body. He would assume all the uncouth faces he saw at a meeting or place of amusement.

A MAN WHO LIVED TWENTY DAYS ON WATER.—About the year 1724, one John Ferguison, of Kilmelfoord, in Argyleshire, having over-heated himself on the mountains in pursuit of cattle, in that condition drank to excess of cold water from a rivulet, and then fell asleep on the bank. He awoke in about twenty-four hours in a high fever, and from that time could retain no kind of aliment, except water, and clarified whey, though he had the latter but seldom. Archibald Campbell of Ineverliver, to whom this man's father was tenant, carried him to his own house, locked him up in a chamber for twenty days, and supplied him himself with fresh water, to no greater quantity a day than an ordinary man might use for common drink; and at the same time took particular care that it should not be possible for his guest to supply himself with any other kind of food without his knowledge; yet, after that time he found no alteration in his vigour or visage.—*Philosophical Transactions*, 1742.

RESTORATION OF ANIMAL LIFE.—Dr. Pecklin relates, in the *Philosophical Transactions*, 1676, an extraordinary instance of a Swedish gardener who, some years previously, endeavouring to help another who had fallen into the water under the ice, fell into it himself, into the depth of eighteen Swedish ells. Here, afterwards, he was found upright, with his feet on the ground, and was drawn up after he had remained there for the space of sixteen hours. He was wrapped closely in linen and woollen clothes, to keep the air from suddenly rushing upon him; he was then lain in a warm place, rubbed and rolled, and then given some spirits to drink. By this means he was at length restored to life, and shown to the queen-mother of Sweden, who gave him a yearly pension, and showed him as a prodigy to divers persons of quality. This narrative was confirmed by the famous Dr. Langelot, who himself received the particulars in Sweden so well attested, "that nothing," says Dr. Pecklin, "can be required more to prove a historical truth."

WONDERS OF PHOTOGRAPHY.

THE photographic art has been brought so completely within reach of the public, that any one who can spare sixpence may possess a specimen of it. This familiarity with its wonderful results, however, co-exists with much ignorance of its methods, and of what may be called its more curious or recondite capabilities.

As an illustration of the popular ignorance about photography, take an instance recorded three or four years ago. A thief went ostensibly to have his photograph taken, but really to see what he could steal. He seized his opportunity when the photographer had retired to develop the plate, and made off with a valuable lens, quite unconscious of the fact that the few seconds he had sat facing the camera had placed his portrait in the hands of the operator. Of course, the means of identifying him speedily found its way into the hands of the police.

An ignorant misconception of exactly the opposite character was displayed a few years ago in a then popular drama. The culprit is detected in consequence of his having accidentally committed his crime in front of a camera and lens, which a photographer had by chance left in the place. The author evidently entertained the strange notion that in all places and under all circumstances, a camera and lens would take a picture of what

passed before them without the intervention of any sort of human agency.* The reader may regard this as a marvel of popular ignorance, just as worthy in its way of being recorded as are the marvels of human ingenuity.

In a similar way, the photographic art has sometimes been credited with what it is altogether beyond its power to accomplish. At various intervals during the last seven years, there have been extraordinary tales afloat of photographs taken from the eyes of the dead, which revealed the last scene impressed upon the retina. It was believed by many that an infallible means of detecting crime would thus be furnished, and that the murderer would leave behind him an exact photographic representation of himself and his evil deed in the eye of his victim. It is hardly necessary to say that this hope has been disappointed, and that press writers have for some time ceased to reproduce the wonderful tale.

The expectation of seeing objects depicted in their natural colours by photography has acted like fascination on many minds, and it would seem that the case is not altogether hopeless, though many practical men doubt if the hope will ever be realised. M. Claudet records that Becquerel and Sir John Herschel have both succeeded in impressing the image of the solar spectrum, and even of coloured maps, upon a silver plate prepared with chlorine. The image, however, was not permanent. M. Niépce de St. Victor went a step further. Taking for his model a large doll, dressed up in the most brilliant colours, he was able to repeat and vary his experiments without the least fear of tiring out his sitter. The result was, after surmounting many difficulties, that he obtained a photographic picture of his model, showing all the colours distinctly, but yet, *as if seen through glass of a pale rose colour.* To look at the photograph was like looking at the doll itself through such a medium. Still, the colours are only a slight degree more permanent than those of the spectra depicted by Becquerel and Sir John Herschel. The picture has to be kept in the dark, and only looked at now and then in the full light of day.

In making the above experiments, M. Niépce produced black and white in his pictures, which he regards as a curious and interesting fact, since it proves that black is not entirely the absence of light, but is a colour of itself, producing its own effects, as other colours do, by chemical action. It is thought by some that this discovery is more extraordinary than would be the production of all the recognised colours in a photographic picture. Dr. Calvert's Canton lectures may be referred to for other experiments made with a view to the production of photographs in natural colours. In a word, the great point yet to be attained is to fix the tints.

Another wonder of photography is the success that has been achieved in taking photographs of objects in motion. For example, a shot or a shell has been depicted at the instant of its leaving the cannon's mouth. By an ingenious mechanical contrivance, the rate at which the shot travels can be ascertained at the same time.

A paper was read by M. Claudet at the meeting of the British Association in 1865, on "moving photographic figures," and these have since been popularised by the production of a toy called the "Wheel of Life." The idea is, in fact, an old one. The writer remembers a similar optical toy having been in existence in his boyhood, but the superiority of the movements of the little figures when produced stereoscopically cannot be doubted. Nevertheless, the idea of producing an appearance of motion by the recurrence of certain images on the retina is the same. The principle is simply this :– the retina retains for a short time any impression made upon it ; if, therefore, a second impression can be produced before the first has died out, the two combine to form an uninterrupted sense of vision. Familiar instances of this law will occur to every one. The appearance presented by the spokes of a wheel in rapid motion ; the circle of fire produced by a spark at the end of a stick, when the stick is whirled round, are cases in point. It is only fair to state that we are indebted to the ingenuity of an American for the enjoyable manner in which the Wheel of Life is now presented to the public. One marvel, however, suggests another, and there is reason to believe that our winter evenings will soon be enlivened by another adaptation of the same idea. A clever designer has prepared diagrams which represent persons in the act of swimming and skating, a cat springing upon a rat at the moment of its disappearance down a hole, a ball leaving a cannon's mouth, and fish swimming in a stream. The most curious of these is the appearance of men swimming. They are all alike seen horizontally, the diagram being placed at the *bottom* of the Wheel of Life as in a tray.

Mr. Alfred A. Pollock, in a communication to the *Photographic Journal* a few months ago (No. 188, p. 160), suggests a process by which a person in motion could be photographed, and afterwards *seen in motion.* His plan is a very simple adaptation of the idea worked out in the Wheel of Life. Instead of the usual negative, a number of plates, say fifty, would be prepared on a disc, and the person whose portrait is to be taken, having been focussed as usual, would be made to walk up and down between certain threads properly fixed for his guidance. The mechanical arrangement would be such as to distribute the two steps of the subject over the whole of the prepared plates at the same instant.

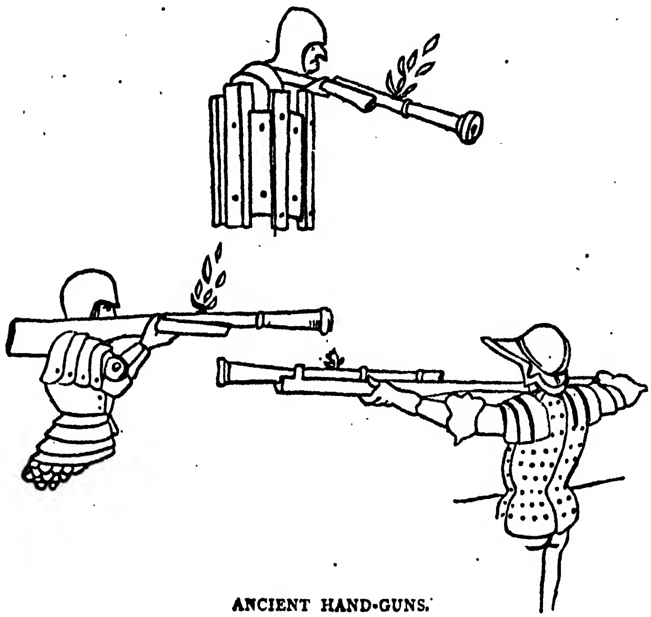
* The *Photographic Journal*, vol. ix., p. 138.

From the negatives so obtained, prints would be taken in the usual way and mounted upon a revolving disc. Looked at through the slit in the same manner as the figures of the toy described above, the person photographed would be seen walking, and the rate at which the disc revolved would regulate the speed of his walk. By this or even by a simpler practical method, there can be no doubt the public will soon be photographed in motion. Already the London Stereoscopic Company have succeeded in producing a marvellous little toy called the Kinescope. This ingenious toy in outward appearance resembles a lock, and it can be worn suspended from the watch-chain like a charm. You look through a small hole, and see one or more figures, which are set in motion by pressing a pin.

The Magic Photograph recently brought out in Paris and London, is contained in two envelopes. White albumenised papers are enclosed in one, and in the other slips of blotting-paper of a corresponding size. One of each of the pieces of paper having been moistened with water, and the one laid upon the other, a beautiful photograph is brought to view on the albumenised surface. In fact, the photograph has been printed in the usual way, and then decolourised by a chemical agent, while the blotting-paper has been prepared with another agent, which only requires the addition of moisture to enable it to restore the photographic image to view. Professor Roscoe illustrated this subject at the Royal Institution in March, 1868, when he developed a latent image on the screen of a magic lantern, so that the whole audience could see it.

OUR ANCESTORS' CANNON.

WELL may we wonder when we see the marvellous contrivances which our ancestors were pleased to call their cannon; still more may we wonder when we read the accounts of what was done with them. Here is a description of what must have been truly wonderful pieces of artillery, used by Philip Van Artevelde at the siege of Oudenarde in 1382. "They with much labour placed on the hill of Oudenarde a prodigiously great engine, twenty feet wide and forty long, which they called a mutton, to cast heavy stones and beams of timber into the town, and crush everything they should fall on. They had also, the more to alarm the garrison, fired a bombard of a very great size, *which was fifty feet in length*, and shot stones of an immense size. When they fired off this bombard it might be heard five leagues off in the daytime, and ten at night. The report of it was so loud that it seemed as if all the devils in hell had broken loose! The Ghent men made likewise another engine which they pointed against the town to cast large bars of hot copper. With such machines as cannons, bombards, sows, and muttons, did the Ghent army labour to annoy the garrison of Oudenarde." In 1383, when the warlike Bishop of Norwich was laying siege to Ypres, he made "a certain subtle bridge" with which to approach the walls, but the besieged, says Walsingham, "threw from a certain gun (de quâdam gunnâ), a great stone which struck the bridge and broke it, and killed some of its occupants." The bishop had to raise the siege, and among his belongings which could not be burned nor broken,



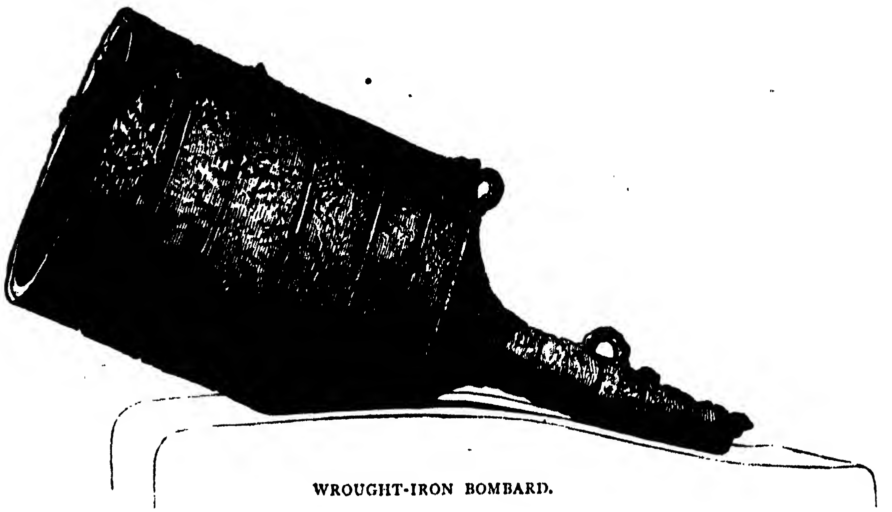
ANCIENT HAND-GUNS.

and had to be left behind, were some "great guns of immense price and value."

In another place we read of an earth cannon; which must have been more formidable to its owners than to the enemy. Earth was scooped out bore-wise to a certain distance in the ground which was fortified by clay, heavy boulders and other pieces of resistance, the earth barrel was strengthened by rods or sheets of metal, and then the charge was introduced, being fired by means of priming which communicated with the lower end of the cannon through a very long touch-hole. As may easily be imagined such a weapon speedily went into disuse.

The cannon used at Oudenarde and Ypres, and, as some writers say, by the English for the first time at the battle of Crécy, were made of metal, iron or brass, hammered; sometimes of iron and copper plates with lead run between them. They were not portable in the sense of being mounted on carriages, but were literally planted in the ground, which had to bear the blow of the recoil and must often have been torn up by it. By the same token they could not be pointed except in the direction first given to them, so that if they were operating against men or horses and these changed their position, the cannon were placed *hors de combat.* They could not have been of very material assistance to the army using them, for the cannoniers of the period were afraid to charge them when heated, and they required moreover a long time to clean out and reload. The Venetians in the war of Chioggia with the Genoese in 1378, had two bombards which they loaded over-night, and fired in the morning, considering, though greatly pressed by the Genoese, that they could not fairly call upon the bombards to throw more than one shot per diem. Stone shot were used, and when they did hit anything it was "a very palpable hit," for they weighed a hundred and fifty and two hundred pounds, and being thrown rather deliberately by the charge, lumped down whole, without scattering. It was by a lucky cast from one of the bombards above mentioned that the Venetians toppled over a wall behind which Peter Doria, the Genoese admiral was sheltered; the wall fell, killing the admiral with some twenty more, and helped materially to end the state of siege.

Men were slow to improve their cannon, for the gentlemen of the army looked upon them as base weapons, unworthy the attention of knighthood, and did not, therefore, study the science of artillery. When engineers, whether knights or otherwise, did give their attention to gunnery—and the French began to do so before any other people—they learned to cast them, instead of welding them together in bars hooped round with strong encircling bands; they reduced the size of them, and they fitted them upon carriages which made them at once movable, and allowed of their being pointed in any direction the gunner in charge might wish. They substituted iron balls and bolts for stone shot, and made both cannon and missile more handy instruments than they had been. The large figure in our drawing shows the form and make of a bombard about the era of improvement. This particular bombard was formerly at Bodiham Castle, and is now among the collection of ancient artillery at Woolwich Arsenal. From the muzzle to the touch-hole it measures twenty-two inches, its total length being forty-four inches; the diameter is fifteen inches and a quarter, and the weight six hundredweight. As will be seen, the ancient bombard corresponded somewhat to the mortars of modern warfare, and some of them were constructed



WROUGHT-IRON BOMBARD.

on the principle of firing three or even nine shots at once; but the practice of shell firing does not seem to have been known.

Wonderful as it may seem to us who pride ourselves on our breech-loading and revolving fire-arms, it is nevertheless true that many of the ancient cannon and hand guns were breech-loaders, and there are specimens of muskets in the Tower at the present moment, supposed to be of the time of Henry VII., which are constructed on the principle of a revolving chamber to a single barrel.

Our ancestors were very slow to extend the principle of fire-arms to manual weapons. The English, who are said to have been the first to use ordnance, did not have hand-cannons, culverins, or hand-guns, as they were called, till a hundred and thirty years after the battle of Crécy, and it was not till Elizabeth's reign that the musket was substituted for the bow and crossbow as the arm of the English infantry. On page 84 is a drawing showing what the hand-gun was like. Improvements were made in it from time to time, but for a long while the musquetoon or other piece fired on a rest, and by means of a blown match instead of flint or a percussion lock, was the regular arm until after the time when hacquebuts, harquebuses, petronels, firelocks, *et hoc genus omne*, had become the arms of precision.

In noticing our ancestors' cannon we ought not to omit mention of the petard, a favourite implement of mediæval warfare. The petard was a French invention, first used in 1579, and was intended to blow in the gates of towns which refused to admit besiegers. It was a portable iron mortar, only instead of being round it was flattened as to its sides, being a sort of biffin amongst cannon. There were small trunnions upon it with which to secure it to walls or gates, and the ordinary size of the petard was such that two men might carry it. It was loaded with coarse powder well rammed down, and there was a touch-hole with a long fuse attached, in the centre of the breech. This instrument was carried by the enemy to the gate or wall which barred progress, and there was fastened by means of the trunnions, the fuse was then lighted, and when it had burnt down the petard exploded, generally blowing in the gate to which it was secured. Fancy two men going quietly up to a town defended by say two Snider rifles, for the purpose of hoisting the gates thereof with a petard. *Nous avons changé tout cela.*

THE LOSS OF THE BIRKENHEAD.

Of all the wonderful instances of human courage on record, there is none more striking than that which is contained in the sad history of the loss of the *Birkenhead* troop-ship. The *Birkenhead* was an iron paddle-wheel steamer, one of the finest of her class. She sailed from Queenstown, Ireland, on the 7th of January, 1852, for the Cape of Good Hope, and took out a detachment of the 12th Lancers, and detachments of nine regiments of the line. She made a fair and prosperous voyage, sighted the Cape, and as she ran down the coast her passengers looked forward to a speedy release from the pleasant confinement of her decks. It was a fine afternoon, the 25th of February—

> "The air was calm, and on the level brine
> Sleek Panope with all her sisters play'd;"

the *Birkenhead* was steaming at full speed towards her goal, not dreaming of harm, and unconscious of the proximity of danger. There were six hundred and thirty-eight persons on board, including the ship's company, and the wives and children of the soldiers.

Suddenly there was a blow that shook every one of the ship's timbers, the *Birkenhead* trembled from stem to stern, stopped, and began to sink. A rock, unknown to navigators had found her out; and, having pierced her side, thrust up its pointed head into the engine-room. There was alarm, but no confusion. Instantly, as though they had been waiting for the accident instead of waiting to go ashore, the ship's officers and the officers of the troops issued their necessary orders. The women and children were taken on the upper deck, and the soldiers were mustered there, while the sailors, in obedience to the captain's commands, lowered the ship's boats and made ready to go.

The boats being manned alongside, the women and children were handed into them, with such of the crew as were necessary to take them to the shore. Few if any of the soldiers who saw their beloved ones departing, were able to go in the boats, for it was found that the utmost the boats could accommodate without endangering the safety of their occupants, was but 184 out of the total number of 638 on board. The land was near, only a few miles distant; Simon's Bay, to which port the *Birkenhead* was bound, was close at hand; there was a chance that the boats might return before the final catastrophe came, or help might come at any moment from the port of destination. Some there might have been who indulged in this hope, and who were sustained by it till it was rudely dashed to pieces; but the majority of the men knew that escape was all but impossible; that before the boats could return from their first trip, to say nothing of a second, all would certainly be over. The force with which the ship struck had been so great as to drive the rock bodily into her; she was being pressed down by the weight of the water that had rushed in, and was showing signs of giving way amidships.

Not a murmur was heard from the soldiers as they stood at their death parade, no hint was there of unruliness, of selfishness, or complaint. With death staring them in the face, the men felt comfort in knowing that the women and children

were beyond the reach of harm. Some few solemn words of consolation, but none of earthly hope, were spoken by the colonel in command of the troops, and the brave captain of the *Birkenhead* was not slow to second him in bidding the men resign themselves to their inevitable fate. Soon the fatal moment came. The good ship which lay so badly wounded on the sharp spear that had pierced her, could last no longer, she gave a few convulsive throbs, there was a cracking and a rending, and the *Birkenhead* parted in the middle, sinking in two pieces on either side of the rock. Long ere the boats could get back to her from the shore; long before the news of her disaster could be told at Simon's Bay, the 454 brave men who had been unavoidably left in her had given up the ghost, had been drowned in the sea or been devoured by the sharks.

Wonders of the Atmosphere.

Red Snow.—This is a phenomenon which is frequently observed in the Polar regions, and has occasionally been met with in the Alps and in Scotland. Captain Ross discovered, on the shore of Baffin's Bay, a range of cliffs extending for eight miles, which were covered with red snow of a brilliant hue, and sometimes as much as twelve feet in depth. The cause of the appearance was a puzzle to men of science as well as to the observers, until careful examination with the microscope revealed that it was due to the presence among the snow of a very minute plant, which has been called by Sir William Hooker *Palmella nivalis*.

Black Rain.—There are on record several incontestable instances of black rain having fallen, among which the following may be mentioned:—Professor Barker, in April, 1849, laid before the Royal Dublin Society some observations on a shower of black rain which had fallen around Carlow and Kilkenny, and extended over an area of more than 400 square miles. He presented to the society a specimen which had been forwarded to him, the person who had collected it mentioning that at the time that it fell it was uniformly black, and resembled ordinary writing ink. Dr. Barker found, however, that after allowing it to stand for a short period, the black colouring matter separated from the water with which it had been mixed, rendering the colour of the rain much lighter than at first. This shower was preceded by such darkness that it was impossible to read except by candle-light. After this darkness had continued for some time, a hail-storm occurred, attended with vivid lightning, but without thunder, and when this subsided the black rain fell. On examination of the rain just after it had fallen, it was found to have an extremely fœtid smell, and a very disagreeable taste; it left a stain upon some clothes on which it had fallen, and cattle refused to drink it. A similar shower occurred near Northampton in July of the following year, and was thus described by the Rev. J. T. Tryon, of Bulwick Rectory. It fell about three or four o'clock in the afternoon, rendering quite black the people's clothes on the hedges, and those spread on the grass to dry; also giving to the water caught in tubs and vessels from slated and tiled houses, almost the colour of ink. Some rain which had fallen in the morning had been perfectly clear, and the black rain appeared to fall from one particular cloud. "It caused," said Mr. Tryon, "a black-lead froth at the top of my tub, so that I myself collected three or four bowls of such froth therefrom. Three days after, two boys loading my wagons with clover were rendered as black as chimney sweepers from the black sediment the rain had left thereon. My shepherd's inexpressibles, up to the knees, were rendered of the like colour after shepherding his sheep, so that it appears the shower was not confined to this parish."

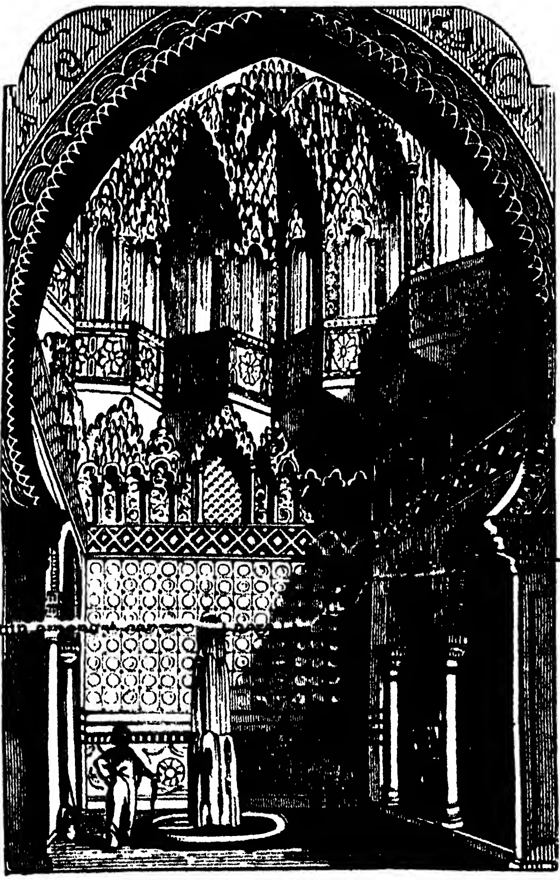
Snow in the Ball-room.—The following anecdote is told by Professor Dove, of Berlin, in illustration of the production of snow by change of temperature. On an extremely cold but starlight night, a large company had assembled in a ballroom in Sweden, which in the course of the evening became so warm that some of the ladies fainted. An officer tried to open a window, but found it was frozen to the sill. He then broke a pane of glass, and the rush of cold air from without produced a fall of snow in the room. Its atmosphere was charged with vapour, which, becoming suddenly condensed and frozen, fell in the form of snow upon the astonished dancers.

THE ALHAMBRA.

On a hill in the city of Granada, a principal town in the Spanish province of Andalusia, stands an extensive fortress known as the Alhambra, or "the red castle." It is the old citadel of the town, and was built by the Moors when they were the masters of Spain. Designed for warlike and defensive purposes only, it has no pretension to architectural grandeur or effect. Its walls, which average thirty feet in height and six feet in thickness, are irregular in form, and composed chiefly of loose stones cemented together, and faced with a plaster coat. The area enclosed by this fortress is very extensive. It is like a town in itself, having its streets, its church, and convent; and is said in its palmy days to have afforded accommodation to a garrison of 40,000 men.

Plain and rugged as is this structure in external appearance, it is the casket which holds one of the richest gems of the architecture of any age or time. Within its walls are enclosed the remains of

the Moorish palace to which the name of "the Alhambra" is generally applied, although it belongs properly to the fortress itself. This palace was built in the thirteenth and fourteenth centuries, and all the beauty and ingenuity of Arabic art were lavished upon its construction. Upon the expulsion of the Moors from Spain, it occasionally became the residence of the Christian sovereigns, and Charles V. designed to place by its side another palace, which should eclipse the glories of the art of the infidel Moor. But this building, although it was commenced, and some very fine portions of it are still in existence, was never completed. Its fragments were suffered to decay when Granada grew in disfavour as a residence with the Spanish monarchs, and, when compared with the remains of the Moorish palace, they now show to great disadvantage; the contrast between the two styles of art and the nature of the workmanship in each is greatly in favour of the Moors. "The walls of the Christian edifice," says one writer, "are defac[illegible] paint[illegible], the w[illegible]ngs faded, the woodwork is decayed, and festoons of cobwebs are seen hanging from the ceiling. In the works of the Arabs, on the contrary, the walls remain unaltered, except by the injuries inflicted by the hand of man. The colour of the paintings, in which there is no mixture of oil, on removing the particles of dust, appear to have preserved their brightness. The beams and wood-work of the ceilings present no signs of decay; no spiders, flies, or other insects are to be seen there. The art of rendering timber and paints durable, and of making porcelain mosaics, arabesques, and other ornaments, began and ended in Western Europe with the Moorish conquerors of Spain."



THE HALL OF THE ABENCERRAGES.

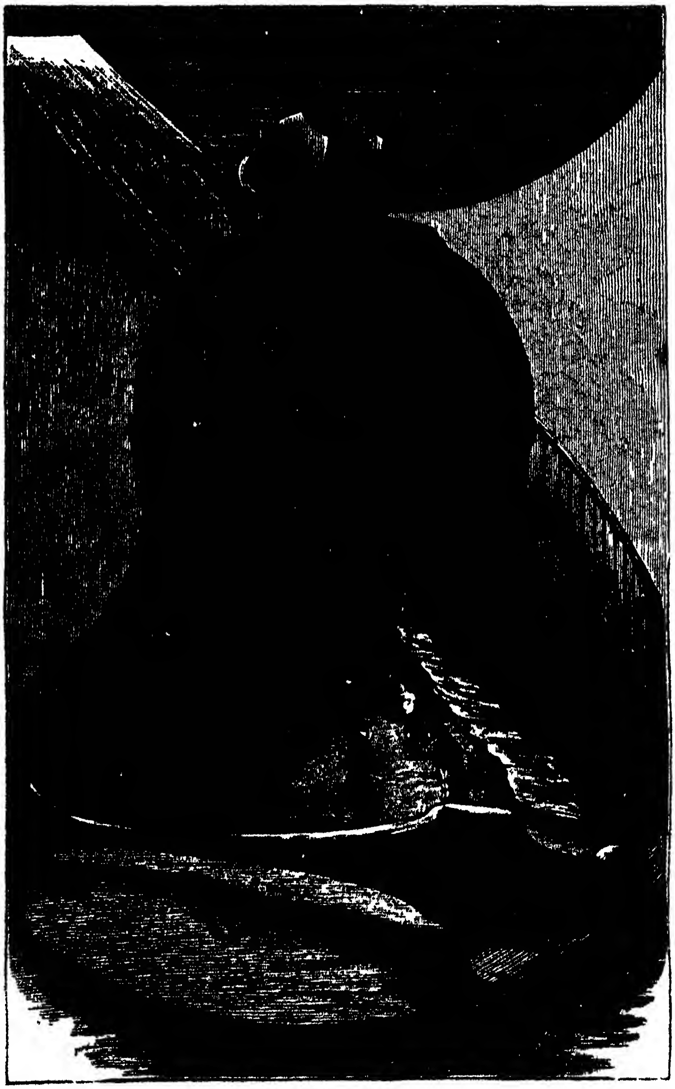
The remains of the palace of the Alhambra consist of entrance-arches, corridors, and courts, constructed chiefly of marble, and richly adorned with arabesques. The Arabs were forbidden by their religion to use the representation of living figures or animals in their ornamental devices, which therefore took the shape of flowers and geometrical forms, sometimes very fanciful in their nature. The term *arabesque* was applied to this class of ornament, after the race by which it was chiefly used. These arabesque ornaments were cast in moulds, and joined with such extreme nicety that frequently no trace of the point of junction can be detected. They were coloured in blue, red, and gold, and the general effect in such edifices as the Alhambra is so gorgeous that it cannot be realised by description. An excellent idea of it, however, was given by the Alhambra Court in the Crystal Palace at Sydenham, which was a most artistic imitation of the original, both in style and material, although on a smaller scale. It is much to be regretted that this beautiful and costly reproduction of Moorish art was defaced by the fire which recently occurred, and which threatened its total destruction; but we hope to see it restored in its full beauty at no distant day.

The style of the courts, &c., of the Alhambra, as well as their elaborate decoration, are shown in our engraving, which represents the saloon known as the Hall of the Abencerrages, with its beautiful stalactite roof, composed of 5,000 separate pieces, fitting into each other with the greatest exactitude. The hall takes its name from a Moorish family, the last members of which were treacherously murdered in this chamber. A mark, said to have been left by their blood, is pointed out upon the marble floor; but sceptical people in later times have declared that it is nothing but the deposit of water impregnated with iron.

WONDERFUL BELLS.

The history of bells is one of the most interesting in the record of inventions. They were not always made in the shape or of the material with which we are most familiar; but of these early forms we have nothing to say just at present. Our business is with bells in their present shape, and with them only so far as they are calculated to excite our wonder by their size or tunefulness.

The earliest church bells are said to have been used at Nola in Campania, and it is to this fact that the Latin name for a bell, *campana*, and our own *campanile*, owe their origin. They are first heard of about the year 400, before which date rattles were used. In the year 610 we hear of bells in the city of Sens; the army of Clothaire, king of France, having been frightened away by the ringing of them. In 960 the first peal of bells was hung in England, at Croyland Abbey, in Lincolnshire. They were six in number. In those early times, it was the custom to bless the church bells by a sort of baptism; after which it was believed they had power to drive away evil spirits, avert tempests, and extinguish fire; and on many bells inscriptions are found, generally in old Latin rhymes, which accord with this belief. The great bell of Ghent, which played so prominent a part in the civil struggles in the Netherlands, and which bore the name of Roland, was famous for an inscription of this nature.



THE GREAT BELL AT MOSCOW.

Many years ago, it was estimated that there were at least 2,262 peals of bells, great and small, in England, viz:—12 peals of 12 bells; 50 of 10; 380 of 8; 600 of 6; 500 of 5; 720 of 4, 3, and 2. The number now must be very much greater. The single bells that have become celebrated on account of their great size are the following:—Moscow, the largest bell in the world, 432,000 lb.; Moscow, another, 288,000 lb.; Moscow, a third, 127,836 lb.; Big Ben, Westminster, 56,000 lb.; Rouen, the George d'Amboise, 36,000 lb.; Oxford, Mighty Tom, 17,360 lb.; Florence, Palazzio Veccio, 17,000 lb.; Exeter, Great Tom, 13,440 lb.; London, Saint Paul's, Tom Growler, 11,230 lb.; Lincoln, Great Tom, 10,528 lb.; Canterbury, clock bell, 7,840 lb.; Gloucester, clock bell, 7,280 lb.; Beverley Minster, clock bell, 5,600 lb. The bell at Florence, notwithstanding its great weight, is elevated 275 feet from the ground. Big Ben, at Westminster, is raised to the height of nearly 200 feet. The enormous bell at Moscow, of which we give an engraving, was presented to the cathedral by the Empress Anne. In 1731, the beam to which it was fastened was burnt, and this marvellous bell falling, a fragment was broken out of it, leaving an opening large enough to admit two persons abreast without stooping. Its tone, however, was not affected.

It has been thought that the custom of ringing tunes upon bells was peculiar to England; but, in fact, the Cathedral of Antwerp, celebrated for its magnificent spire, has a peal of ninety-nine bells, on which the most elaborate music is played every half-hour.

It is an interesting fact that the peal of bells in the clock-tower of the old Royal Exchange was chiming "There is nae luck aboot the house," when the building was on fire, and fragments of the tune were heard as one by one the bells fell from their places into the ruins.

The following table shows the number of changes that can be rung. Thus:—

ON A PEAL OF	CHANGES.	ON A PEAL OF	CHANGES.
2 bells	2	8 bells . .	40,820
3 "	6	9 " .	362,880
4 "	24	10 " . .	3,628,800
5 "	102	11 " . .	39,916,800
6 "	720	12 " . .	479,001,600
7 "	5,040		

The number of changes that can be rung on the wonderful chime of ninety-nine bells at Antwerp we forbear to estimate, as the breadth of our page would far from suffice for the row of figures we should have to set down. On these bells overtures are played *through*, and choice parts from operas, and, in a word, the most elaborate of compositions. But further, to convey an idea of the astonishing numbers we have here to contemplate, it would require ninety-one years to ring through all the changes on a peal of twelve bells, supposing ten changes, that is, 120 sounds, to be struck every minute. For the changes of fourteen bells, 16,575 years would be required, and for twenty-four bells, beyond which number we refrain from proceeding, 117,000,000,000,000,000 years.

THE LAKE OF CIRKNITZ.

In Krain, among the Julian Alps, lies the celebrated Lake of Cirknitz, the wonder and enigma of the whole district. On the east of Adelsberg, where the mysteries of the lower world lie concealed in a hundred caverns among the chalk hills, may be seen, like a mirror three square miles in extent, the marvellously beautiful Lake of Cirknitz. Five islands stud its surface, and on one of them stands the village of Ottok. Several streams fall into it. It is very rich in fish and water-fowl, and the whole district in which it lies is romantically beautiful. North of it tower the Slivinitza Mountains, to its south and west the great Javornik. Its circumference augments when there has been much rain, but after a drought its waters disappear into the lower world, taking with them the fish and the water-fowl. When this wonderful phenomenon approaches, the inhabitants of the villages round assemble in order to procure as much fish as possible while there is time. From hour to hour the lake sinks lower, until a number of holes at the bottom of the lake swallows up its waters. Subterraneous openings of immeasurable extent, never beheld by human eye, at length receive them, and then they entirely disappear, and the bottom of the lake looks up to the bright sky. It becomes dry, and busy man mows grass where at other seasons he has fished. He even sows crops, knowing well that he will be able to grow buck-wheat and millet there; nay, he takes the gun instead of the fishing-net, and obtains game. So that it is justly said of this wonderful lake, that one can fish, hunt, and reap on it. But the weather changes again, and violent rains and tempests return. Then again the waters rush up from their subterranean caverns. The lower world throws up waves, fish, and water-fowl, so that, in four-and-twenty hours the lake is, as it were, created anew. This singular phenomenon is accounted for by the connection of the lake with subterraneous openings, some on a higher, others on a lower level than itself.

HARTLEY'S COOLNESS AT GIBRALTAR.

Summer time in sunny Spain, and the great Rock of Gibraltar reflecting the ardent rays; everything barren, arid, scorched, and the heat insufferable in spite of the gentle breezes now and then wafted from the blue Mediterranean—wafts of air invaluable, since they bore away the dense clouds of smoke that hung about the face of the rock, filling the casemates, and blinding the gunners with their sulphurous fumes. For one of the great sieges to which this fortress has been subjected was at its height, and the jealous Spaniard eagerly watched for an opportunity of dislodging the gallant islanders who held that portion of his soil. The business of the siege progressed. The rock by the batteries sent forth its splinters to deal destruction around at every impact of the Spanish shot; but the return fire was of the most telling description, and most steadily kept up, our men feeling proud of the opportunities given for silencing the guns of the Don.

But removed from the smoke and din, in the laboratory of the garrison, surrounded by the chemistry of war, sat one man, a humble private of artillery. His it was, while his comrades worked the guns in the suffocating casemates of the covered batteries, to prepare the shells for the use of the mortars. A dangerous task; so dangerous, in fact, that even the examination of the deadly missiles is considered sufficiently perilous on board ship to warrant a stage being slung over the side, to be occupied by only one or two men, the others being kept at a distance. But familiarity with peril robs men of their fear, and Hartley sat busily making ready shell after shell, filling them with the explosive composition, and afterwards fitting in the

fuses, driving them home, and ranging the prepared shells in cases till they should be fetched, to be sent in fiery arcs to deal death and destruction amongst the enemy.

The laboratory was at that time full of explosive material, every grain of which was of inestimable value to the beleaguered garrison; and it had been accordingly placed in a position which rendered it impossible for the shot or shell of the enemy to reach it. But now the danger guarded against from without threatened, if possible, more terribly from within—threatened to destroy at one blow the whole of the explosive compounds stored for defence, and this at a time when such a loss would have been irreparable. Shell after shell had been filled, the grim black spheres, as they lay ready, giving but small signs of their deadly power—the force that should rend them into innumerable shards of cast-iron, each to maim or slay. Suddenly, while calmly proceeding with his work, and driving a fuse into a fresh-filled shell, the fuse took fire, hissing loudly as it discharged its rain of sparks, and burning rapidly away. There seemed hardly time for thought, much less for action, and the first feelings of Hartley were those of blank dismay. He had seen the discharge and flight of shells so often, that he knew he could only reckon upon its burning for seconds; and then would come the dire explosion that should act upon the part of the fortress where he was like an earthquake—the bursting of the shell being, as it were, but the flash in the pan that should prelude the blowing up of the laboratory. But with the calmness of a man whose trade was one which brought him daily face to face with death, Hartley seized the shell in both hands, hurried out into the open air, and then with a tremendous effort hurled the deadly globe far into space, where, a couple of seconds after, it harmlessly burst. It was not until some time had elapsed, that the performer of this daring act could thoroughly realise the great danger that had threatened him with destruction; and though the peril was now past, it was some time after, and then only with unstrung nerves, that he returned to his perilous task, probably never for a moment thinking, in his humility, that his had been an act which history would hand down to posterity.

Wonders of Animal Life.

TAMING A SPIDER.—The Abbé d'Olivet, author of the Life of Pelisson, inserted in the History of the French Academy, relates the following anecdote:—"Confined at the time in a solitary place, where the light of the day penetrated only through a small slit, having no other servant or companion than a stupid and dull clown, a Basque, who was continually playing the bagpipes, Pelisson studied to secure himself against an enemy which a good conscience alone cannot always repel—I mean the attacks of unemployed imagination, which, when it once exceeds proper limits, becomes the most cruel torture of a recluse individual. He adopted the following stratagem:—Perceiving a spider spinning her web at the aperture before-mentioned, he undertook to tame her, and to effect this he placed some flies on the edge of the opening, while the Basque kept playing on his favourite bagpipe. The spider by degrees accustomed herself to distinguish the sound of that instrument, and to run from her hole and seize her prey; thus, by always calling her out with the same tune, and placing the flies nearer and nearer his own seat, after several months' exercise he succeeded in taming the creature so well that she would start at the first signal to seize a fly at the farthest end of the room, and even on the knees of the prisoner."

MATERNAL INSTINCT.—Early in August, 1868, a fire occurred in Red Lodge Nursery, a mile and a half from Southampton, and burnt about ten rods of furze. There was no wind at the time. When the fire was extinguished, some labouring men noticed that a little plot of heath in the centre of where the fire had been was not burnt, and that the fire had burnt everything round the heath, and had approached close to it. In looking about, the men discovered a pheasant's nest containing six eggs among the heath. A few hours afterwards the pheasant was seen sitting on the eggs. Some time after, the nest was visited, and the parent bird was absent, but the eggs were nearly hatched. When the nest was again visited, the pheasant had hatched the eggs, and carried off the young birds. It is remarkable that the heath was not burnt, as it was perfectly dry, and it is believed that the pheasant had, by flapping her wings, kept the fire off.—*Times*, *Aug.* 6, 1868.

THE STEAM-HAMMER AND THE AIR-HAMMER.

THE Steam-hammer has now become indispensable in every engineering workshop, and its introduction marks a new period in the history of mechanical progress. It was invented by James Watt and Deverell, and patented nearly half a century ago; next, Mr. Nasmyth designed and applied at Patricroft Works the self-acting motion, so as to complete the steam-hammer in its present compact and manageable form; and the circumstances of the invention and improvement are proved by the testimony of Mr. Gaskell and D. W. Fairbairn, as stated in the *Mining Journal*. In this extraordinary implement or tool, a heavy block of cast iron, sometimes five tons in weight, and attached to the lower end of a piston-rod

working in an inverted cylinder, is lifted by admitting the steam beneath the piston, and then allowed to fall upon the work by its own weight; by a little management it may also be made to slide up and down without striking at all. The heaviest work is forged under the blow of this ponderous hammer, which acts with an energy that the strength of iron cannot withstand; yet it is kept in such control that a nut-shell may be cracked, or an egg-shell chipped, as easily as iron beams are welded or shaped. By means of this machine a pile can be driven into the ground in four minutes that previously required for the operation twelve hours. The saving of time thus effected is as one to 1,800; and it is impossible to express more strikingly the power of this wonderful tool. Several team-hammers of from four to ten hundredweight re now working at Sheffield, with which 500 or 00 blows per minute can be struck if required. Mr. Nasmyth has also produced a steam-engine, somewhat pyramidal in form, which is greatly sed in steam-ships; he has invented a planing nachine, known as "Nasmyth's steam-arm;" he as made a circular cutter for toothed wheels; and with a fine telescope of his own making, he has made out that the bright surface of the sun consists of separate insulated individual objects or things, all nearly of one definite size, and in shape something like a willow-leaf. Sir John Herschel describes this as a most wonderful discovery.

In the Air-hammer, compressed air is employed as the moving power in the place of steam, in Mr. Nasmyth's implement. The machine consists of a force-pump, supplying compressed air to a reservoir, and a working cylinder and piston similar to those of a steam-hammer, having mechanism for varying the action of the hammer as required, and increasing the rapidity of the blows, which may attain a maximum of 800 strokes per minute. One of the largest air-hammers yet put to work has a cylinder eight and a half inches in diameter, with a stroke of twenty-eight inches; and the pressure may be adjusted to any amount, from five pounds to forty pounds per square inch. Grimshaw's high-speed compressed air-hammer is now employed in Birmingham for various stamping and forging purposes; at Glasgow for coppersmiths' work, and at Sheffield for steel-work.

TROPICAL VEGETATION.

It is hardly possible for one who has not visited the tropics to imagine the wonders of tropical vegetation. The most faithful picture, the most finished photograph, give but an idea of what it really is; and the ablest description is but a word-painting in which the variety of hues, the graduated shades of colour, the immensity of size, and the grandeur of the reality are more or less wanting. There is not anything in this country with which to compare the richness of the tropical growth; and lovely as are the tints in a wide-spread English landscape, they are as nothing in point of splendour to those of the tropical scene. Accessories of sun, sky, and temperature, which there serve to bring the principal into greater prominence, are represented here only in an inferior degree.

Particular reasons, connected with a great rainfall and with the size and number of the rivers, render the South American continent luxuriant above most other places in the quantity and richness of its vegetation. From the shore of the Gulf of Mexico to the frontier of Chili, there is a wantonness of growth which is truly wonderful. Had not man carved out a place for himself, the huge forests which now cover league after league of ground would have stretched down to the water's edge, and filled the whole land with their branches. As it is, they oppose a resistance to man's advance, surmountable only by the most untiring energy; and wherever they have an opportunity, they begin afresh in any spot which is temporarily left uncultivated.

What a scene is presented to one who would penetrate the borders of a forest whereon the hand of man has not been laid! Such forests might be found in the Old World, but it is in the New that they are found in the greatest perfection. The foreground is taken up by vast families of many kinds of shrubs, which the influence of the climate tends to make gigantic; the cactus and prickly pear unite with the merciless "Spanish needle" to form a hedge through which no tiger could force his way; ferns higher than a man's head join with the many kinds of grasses to produce an impracticable footway, in which lurk the cobra and the rattlesnake, ferocious centipedes, the whole family of scorpions, and the rest of the creatures which were doomed to wound man's heel. Like watch-towers in the sea of vegetation, the wild plantain and banana, the castor-oil plant, the India-rubber tree, the wild grape, and the cotton shrub, stand out above the level at which the jungle growth stops short; and creeping up around them, the sweet potato and the cassava intertwine their creepers. A clump of mangrove bushes marks the spot where water cannot soak through the saturated ground, and the maize standing stiff in *terra firma* beyond, shows the partial character of the swamp. The lesser palms, the trumpet tree, the roseau cane, the standard fig, and the cocoa shrub, are represented at intervals here and there.

A path, cut out as through stonework in this densest of thickets, leads to the border of the forest itself, where the strong glare of the noonday sun cannot enter, save in a subdued form through

openings made by the fall of some forest giant, or through the apertures occasioned by the freaks of nature in the disposition of the trees. The same shrubs, and grasses, and ferns, and creepers which covered the foreground and made it all but impassable, are here to be seen occupying the fruitful ground, so that all spaces between the trees are closely filled up, while in and out among their stems climbers of enormous strength bind them together and to the trees, covered with parasitic climbers. Among the trees of the forest are almost all the trees that grow, save those peculiar to the temperate zone. The ironwood, the cedar, the locust tree, the mastic, the satinwood, mahogany, bully tree, and rosewood, with the various kinds of gum tree and logwood, form the staple of the community. The great chinchona tree, from the bark of which quinine is drawn, heads a division of no mean strength, while every variety of palm and cocoa-nut rear their graceful and gigantic stems in every spot where they can find an opening. So thickly are these trees planted, so innumerable are their allies, so closely are the interlacing branches bound together, that the sky is visible in only a few places. The full-page illustration which accompanies this article will convey to the reader as good an idea as it is possible for a picture to give of the gorgeous and luxuriant growth of these tropical forests, with the trees covered with the richest blossoms, and interlaced with festoons of creepers and parasitic plants. Among the gorgeous blossoms of the hundreds of wild flowers that embrace the trees, haply a scarlet snake or a whip snake may be seen hanging from some branch, deceiving the traveller by its blossom or tendril-like appearance, ready to do him to death in the event of his coming within reach. Animal life swarms in these forests with amazing abundance. "Parrots of various species and brilliant plumage; birds innumerable, from the scarlet flamingo to the tiny humming-bird, nestle in every branch; while the thickets swarm with wild animals in such prodigious numbers, that it appears hardly conceivable how they can all find subsistence. Tigers, jaguars, tapirs, monkeys, wild boars, deer, besides smaller quadrupeds, abound in every direction; and by a peculiarity very remarkable, and unknown elsewhere, they all begin at the same hour of the night to raise their respective cries, and fill the forest with a chorus so loud and dissonant that sleep is for hours impossible to the wearied traveller. So universal and well known is this custom, that the monks, in their journeys on the shores of the Orinoco, before lying down, pray 'for a quiet night and rest as other mortals.'"

No words can convey any idea either of the height or girth of the great trees. Twelve, eighteen, twenty, and five-and-twenty feet, do some of the monsters measure round the waist, while for height they may be compared to those hills whereof Othello said that their "heads touch heaven. Seventy, and even a hundred feet of clear stem, without a branch—such is the measure of many of them; while it would be almost impossible to calculate the quantity of wood contained in one great tree and its branches. This is the aspect of forests covering the ground for many hundreds of consecutive miles, in parts of South America.

LAKE DWELLINGS.

Among the most interesting discoveries of recent times are those relating to the subject of "prehistoric man"—that is, to man as he lived in various countries before our existing historical records were compiled. Many remarkable facts in this direction have been ascertained, although this branch of research is as yet quite in its infancy. The "lake dwellings" of ancient times form a prominent feature in these inquiries, and we shall briefly relate the principal discoveries concerning them.

Strictly speaking, these lake dwellings are not "pre-historic." The "father of history," Herodotus, writing of the invasion of Thrace by Darius, the Persian king, mentions an unsuccessful attempt of one of his commanders to subdue the inhabitants of Lake Prasias, which is found in the present day in the Turkish province of Roumelia. He says of the Prasians, "They inhabit dwellings of the following construction: in the lake, strong piles are driven into the ground, over which planks are thrown, connected by a narrow bridge with the shore. These erections were in former times made at the public expense; but a law afterwards passed, obliging a man for every wife whom he should marry (and they allow a plurality) to drive three of these piles into the ground, taken from a mountain called Orbelus. On these planks each man has his hut, from every one of which a trap-door opens to the water. To prevent their infants from falling into the lake they fasten a string to their legs. Their horses and cattle are fed principally on fish, of which there is such abundance, that if any one lets down a basket into the water, and steps aside, he may presently after draw it up full of fish."*

This description by Herodotus, of a state of things existing about 500 years B.C., had been received, like many other of his narrations, with incredulity, until recent investigation brought to light the fact that precisely similar colonies had existed abundantly in Europe before our history commences. The manner in which the discovery was first made is remarkable.

The winter of 1853-54 was an unusually dry season, and the waters of the Swiss lakes were in-

* Herodotus, Book V., Beloe's translation.

consequence very low. The residents on the Lake of Zurich thought they would seize the opportunity to reclaim a portion of the land left dry by the sinking of the waters; and while the works necessary for this object were in progress, a great quantity of piles were discovered embedded in the lake. Together with these piles were found portions of the framework of wooden buildings, with a quantity of rude implements, and the remains of food which the inhabitants had consumed, such as bones, the seeds of fruit, nut-shells, &c. Being deeply sunk in the soft mud, these vegetable relics were in sufficient preservation to be easily identified.

This discovery led to the careful examination of the shores of other lakes in Switzerland, and it was found that the evidences of these lake colonies were so abundant as to lead to the conclusion that they had formed the customary habitations of the ancient Swiss tribes. The reason for their selecting such a mode of life, it has been conjectured, was to guard against the predatory attacks of enemies, as the narrow strip of causeway leading from the dwellings to the shore was capable of easy defence, and may have been provided with something in the nature of the drawbridges attached to the castles and moats of the middle ages.

Very similar structures were used for defensive purposes in Ireland and Scotland in recent times; and the remains of these "crannoges," as they are called in the Celtic tongue, are common in the lakes of both countries. It does not appear, however, that lake dwellings were grouped together there, as in Switzerland, in such numbers as to accommodate a population of some hundreds, but rather that they were used merely as strongholds to which the native chiefs could occasionally retreat in time of war.

In some parts of Germany remains similar to those of the Swiss lakes have been found, and it is believed traces of such dwellings have been observed in England; but at present the inquiry is not sufficiently advanced for anything definite to be known on the subject.

At the present day, habitations in some respects similar to the ancient lake dwellings are found in South America, and the islands of Borneo and New Guinea. The natives in these places occasionally erect their huts on piles driven in shallow streams or marshy places, as a protection against inundations. It may be worth the while of archæologists to consider how far the same reason alone may sometimes have operated to cause the erection of the lake colonies in Switzerland—a country which was possibly far more subject to sudden inundations in ancient than in modern times.

The very rude implements discovered in the remains of the lake dwellings show that their inhabitants were comparatively ignorant of the arts of civilised life. In the earliest of these remains, the hatchets and knives which are found in abundance consist merely of flint stones chipped to the shape required; and the bottoms of the piles frequently show that they were pointed and fashioned by these rude means alone. The use of such weapons has given rise to the term "the Stone Age," relating to one of the pre-historic periods. This was succeeded by "the Bronze Age," when people had learned to substitute such savage implements by a mixture of copper and tin; and of this material some relics are found in the later deposits in the lakes. Afterwards came the "Age of Iron," when the lake dwellings and their inhabitants appear to have been swept away. The charred state of the wood found on the sites of these dwellings shows that their destruction was usually effected by fire—the readiest means by which a more "civilised" race could effect the subjugation of these primitive tribes in their chosen retreats.

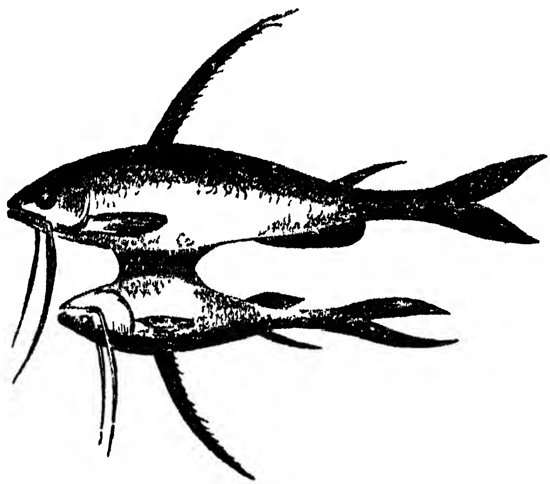
WONDERS OF MEMORY.

THE uniformity of Nature's laws among the lower animals forms a strong contrast to the various tones and speeches by which human thought makes itself known, and which give best exercise and scope to the faculty of memory, especially the memory of sounds and words. Morton, an Englishman, could repeat from memory a discourse delivered in his presence. Claudius Menetrier could repeat three hundred arbitrarily connected words, which had been once uttered in his presence, in the same order in which he had heard them; while a pupil of Schenkel (inventor of one of the arts of memory), could repeat an equal number of words, and as many as two hundred and forty sentences, also in the same order in which they had been heard. The celebrated Picodella Mirandola retained as many as two thousand names from a lecture to which he had listened but once; and the power of memory by which, according to Seneca, Cineas, the ambassador of Pyrrhus (and another whom he mentions, who could repeat verbatim a foreign poem which he had heard once), became the marvel of that age, seems to have been a similar faculty to that which made the Florentine Magliabecchi the wonder of his contemporaries. The latter could not only retain the whole contents of a book once read, but he could recollect the number of a page in which such and such a passage occurred, and possessed also a wonderful memory for places, instantly recalling every detail of a locality which he had seen only once, and that many years before. Joseph Scaliger learned by heart all the songs of Homer in one-and-twenty days, and the works of all the Greek poets in four months; and many

others, enjoying an equal reputation for retentive and faithful memory, might be enumerated—as Themistocles among the ancients, and Pascal, Leibnitz, and Locke among the moderns. Surprising, indeed, as are these instances of accuracy in remembering words, they are surpassed by instances on record of memories which could retain a prodigious stock of numbers and figures, which occasionally border on the incredible. As, for example, when we hear of the man who could not only remember the names of all the soldiers in a battalion after hearing them once, but thirty geometrical figures, in which he had all the geometrical operations as clearly before him as if they were placed on a table beneath his eyes. In this way John Wallis extracted the square root from two hundred and eighty figures, which had been given him in the dark.

Wonderful Fishes.

DOUBLE CAT-FISH.—Professor Silliman's name is well known in Europe as that of an American savant who delights in making the public acquainted with the novelties that come under his observation, and with the discoveries of science.



DOUBLE CAT-FISH.

The above engraving represents a double cat-fish that was presented to the professor about thirty-five years ago. It was taken alive in a shrimp-net at the mouth of Cape Fear River, near Fort Johnson, North Carolina. The two fishes were joined much in the same manner as the Siamese Twins, by a piece of skin on the breast, the point of union being marked by a dark streak, otherwise the appearance of the skin was not found to differ from that of the fish's belly. There was no connection between the viscera of the fishes, but the integument was hollow or double, so that, when an incision was made in one of the fishes and the entrails taken out, a flexible probe could be passed through into the body of the other. The integument was thin and very flexible, so that the two fishes could almost swim together in the natural position at the same time. The difference in the size of the two fishes is worth remarking. It is quite evident that the larger one must have got the start of the other in the race of life, and that it had continued to appropriate the lion's share of the good things which fell to their joint lot. The little fish, indeed, must have shown some dexterity to live at all, and surely deserved infinite credit as a "snapper up of unconsidered trifles."

POWER OF THE WHALE.—If the whale knew his own power, he would easily destroy all the machinery which the art of man could devise for catching him; it would be only necessary for him to swim on the surface in a straight line, in order to break the thickest rope, but instead, on being struck by the harpoon, he obeys a natural instinct, which, in this instance, betrays him to his death. Sir Humphry Davy, in his "Salmonia," observes that the whale, not having an air-bladder, can sink to the lowest depths of the ocean, and mistaking the harpoon for the teeth of a sword-fish or a shark, he instantly descends, this being his manner of freeing himself from these enemies, who cannot bear the pressure of a deep ocean; and from ascending and descending in small space, he thus puts himself in the power of the whaler. If we include the pressure of the atmosphere, a body at the depth of 100 feet would sustain that of sixty pounds on the square inch; while one at 4,000 feet, a depth by no means considerable, would be exposed to a pressure of 1,830 pounds. We need not, therefore, feel surprised that on the foundering of a ship at sea, though its timbers part, not a spar floats to the surface; for if the hull has sunk to a great depth, all that is porous is penetrated with water, or is greatly compressed. Scoresby states that when by entangling the line of the harpoon, a boat was carried down with the whale, it required after it was recovered, two boats to keep it at the surface. As soon as the whale dives after having been wounded, it draws out the line or cord of the harpoon, which is coiled up in the boat, with very considerable velocity. In order, therefore, to prevent any accident from the violence of this motion, which might set the side of the boat on fire, one man is stationed with an axe to cut the rope asunder if it should become entangled, while another furnished with a mop, is constantly cooling with water the channel through which it passes.

BRAVERY is a quality with two aspects. There is a bravery which springs from a natural inability to entertain fear, and a bravery which is the result of deliberate acceptance of the post of danger. There is also a pseudo-bravery, which springs from ignorance both of the extent and proximity of danger—a bravery which is often seen in the hunting-field, in the foot-ball match, in the amateur Alp climber, in many a field where danger is the excitement and the attraction, and where those who join in the sport are unable to measure the height of the excitement which is their lure. The highest form of bravery is undoubtedly that in which the danger being known, he who is exposed to the danger deliberately and of free choice undertakes a post where he will infallibly come in for some of that danger's influence. Men with a nervous temperament who do this are eminently brave, seeing that they have to overcome a natural repugnance to overstep the bounds of caution, as well as to decide for other reasons upon taking the perilous path. There are not wanting many examples of all the kinds of bravery. It is proposed now to give an example of one of the most consummate acts of bravery, involving utter self-devotion, which it has been the duty of historians to record.

For many years after the Counts of Hapsburg, who were Swiss citizens, had been raised to the imperial throne of Germany, they strove by all the means in their power to bring the Swiss under German dominion. They affected sovereign rights over a large portion of the cantons, and did their utmost to enforce their claim. Such pretensions met with the most strenuous resistance, notwith-

standing the great disparity in the opposed forces. The Swiss were actuated by all the motives that can stir a freedom-loving, free-born people, when the question of their independence is vexed by a powerful enemy able and anxious to do them harm; and the Germans were actuated by the lust of power, and by that hatred which all enslaved peoples have for those who are not as themselves. On many a hard-fought field had the question been raised to the music of clanging blows on helmet and cuirass, and to the dirge of many a stalwart warrior. On almost every occasion the cause of freedom had triumphed, and the chivalry of Austria had gone down before the terrific ardour of the Swiss peasants; but perseverance was beginning to tell upon the Swiss strength; for every man they lost, the Germans could bring ten fresh men, while the gaps in the Swiss ranks were far from easily filled up. The spirits of the patriots were beginning to be depressed by the continuousness of the war, and when they were called to arms in the summer of 1385, as they had been called for many seasons before, they answered quickly, but with feelings which were closely akin to despair. The imperial army was powerful, contained some of the flower of German knighthood, and was led by a general who was famed throughout Europe for his skill. Already it had penetrated far into Swiss territory, the weak of heart had given way before it, and there was imminent danger of an advance into the heart of the home of freedom. From village and hamlet, from town and suburb, the Swiss warriors came with something of the sense of a forlorn hope mingled with the valour of desperation in their breasts. They could die, and they would die, in defence of their country, but they were oppressed with the belief that even this sacrifice would be unavailing to save their children from the disgrace of foreign dominion.

At Sempach the armies met, and the Swiss, according to their custom, attempted by a furious onset to take their enemy's position by storm. To resist them, the iron-clad soldiers of Austria and Swiss. The impetuous valour of the mountaineers was thrown away upon such a defence. They came on, swinging their two-handed five-feet-long swords, striving to find a weak place wherein they might thrust the thin end of their military wedge; but they were rolled back again, unable to break the serried mass of steel. It was a critical moment; if the Swiss could not succeed in sustaining their attack, they must be subjected in their dispirited condition to an attack themselves; defeat would be disaster; even a retreat would lay the country open, and necessitate the withdrawal of the patriots to their hills. If the German phalanx could only be broken the least bit; if room were made in it for but one Switzer to get his sword in, then the issue of the fight might safely be left to the strong arms and deep-biting swords of the patriots. But the opening must be made at once; the strength of the assailants becoming exhausted, their spirits must be raised forthwith if anything is to be done.

At this juncture it occurred to the mind of one of the Switzers how an opening might be made in the German ranks. If a number of the lance-points which presented themselves so forbiddingly could be entangled, the assailants might strike in and strike down the lance-holders ere they could recover from their confusion. What better, what surer way of entangling them than by burying them in a human body? Such was the thought of Winkelried, a gentleman of Unterwald. He was a husband and a father, but above that he was a Swiss. Switzerland was his country, all her sons were his brethren; he might safely, therefore, leave the charge of his dear ones to those who were so closely related to him. Certain death was the inevitable result of what he proposed to do; but what he proposed to do was necessary; let the result then look after itself. Commending his wife and children to his countrymen's care, Winkelried rushed forward alone towards the row of steel points. He came up to the sharp outer edge, and gathering up as many lance-heads as he could in both his arms, suffered himself to be pierced through and through. He attained his object, and his dead body won the victory. Before the astonished Germans could pluck their lances out, the infuriated countrymen of the fallen had passed over his corpse, and were among them with the terrible two-handed swords. The fury of the attack overbore all the valour of the Austrians; they fought well, and many died bravely, but they could not prevail; and in an hour after Winkelried had breathed his last, such of the Germans as survived were flying from that bloody field of Sempach, with experiences which did not allow them ever again to attempt the conquest of Winkelried's countrymen.

THIN SHEETS OF IRON.—Many years ago, there was sent to England from Pittsburgh, in the United States, a letter written on a sheet made from iron, 1,000 sheets of which laid upon each other would only make one inch in thickness; the dimensions being 8 in. by 5½ in., or a surface of 44 inches, and weighing 69 grains. Since then, Wales has surpassed America, Staffordshire has surpassed Wales, and Wales again surpassed Staffordshire, till at length Swansea succeeded in making a sheet of the finest appearance, and thinnest that has ever yet been seen by mortal eyes, 10 in. by 5½in., or 55 inch surface, and weighing but 20 grains, and being, indeed, a

sort of iron "gossamer." This being brought to the standard of 8 in. by 5½in., or 44 surface inches, is but 16 grains, or 30 per cent. less than any previous effort, and requiring at least 4,800 sheets to make one inch in thickness. By way of comparison we may add that one grain of gold may be extended over 56 square inches of surface, and gold leaf is only about $\frac{1}{200000}$ of an inch in thickness; some authors say $\frac{1}{280000}$ of an inch. A single grain may be drawn out into 500 feet of wire. Tin is expanded by rolling or hammering, or by a combination of the two operations, into leaves or sheets barely one-thousandth part of an inch in thickness, under the name of *tin-foil.*

A Fairy Coach.—The following description of a coach made by Camus, a French mechanician, for the amusement of Louis XIV., when a child, reminds one of the wonderful equipages occasionally mentioned in fairy tales. It is given by Sir David Brewster in his "Letters on Natural Magic." The coach was a small one, drawn by two horses, and contained the figure of a lady within, with a footman and page behind. When this machine was placed at the extremity of a table of the proper size, the coachman smacked his whip, and the horses instantly set off, moving their legs in a natural manner, and drawing the coach after them. When the coach reached the opposite edge of the table, it turned sharply at a right angle, and proceeded along the adjacent edge. As soon as it arrived opposite the place where the king sat, it stopped; the page descended and opened the coach door; the lady alighted, and with a curtsey presented a petition, which she held in her hand, to the king. After waiting some time, she again curtseyed, and re-entered the carriage. The page closed the door, and, having resumed his place behind, the coachman whipped his horses and drove on. The footman, who had previously alighted, ran after the carriage, and jumped up behind into his former place.

Whitworth's Measuring Machines.—Mr. Whitworth, the eminent engineer, whose specialty is the perfection of accurate proportions, has built up steel guns in which the breech is screwed in, being formed of one, two, or three concentric cylinders, so exquisitely perfect in manufacture that every thread of them fits into its appointed groove with the nicest accuracy, never failing to run smoothly with the other. Such nicety has only been rendered possible since Mr. Whitworth invented an apparatus for measuring to the *millionth of an inch*, and produced absolutely two planes which may float on each other, separated by a thin film of air; or if this film be pushed aside by sliding the top plate forward, instead of placing it at once face to face with the lower one, the two will adhere together as if made of one piece. Mr. Whitworth has deposited in the South Kensington Museum, to be there perpetually preserved, three original true planes and a measuring machine, an instrument demonstrating the millionth part of an inch; and has provided, by endowment, for the delivery of lectures to explain such instruments. Their importance will be manifest when it is considered that the value of every machine, when made of the best materials, depends on the truth of its surface and the accurate measurement of its parts. Mr. Whitworth has shown that the fineness of measurement obtained by his machine is sufficient to detect the expansion in length of an inch bar caused by a momentary touch of the finger. In his larger machine for measuring the standard yard, with a bar 36 inches long, the same amount of expansion is shown by the momentary contact of the finger-nail. The finest measurement requires the precautions of freedom from dust and moisture in the atmosphere, and from any current of air interfering with uniformity of temperature; the machine is therefore kept in its glass case during the time of use, with an opening only sufficient for moving the micrometer-wheel and lifting the gravity-piece. By sufficient care in these respects, the measure of a space corresponding to half a division on the wheel, or the $\frac{1}{2000000}$ of an inch, has been rendered distinctly perceptible

THE REAL QUEEN OF THE GIPSIES.

We have all heard of Margaret Finch, the Queen of the Gipsies. This extraordinary woman was born at Sutton, in Kent, and lived to the great ag of 108 years. After travelling all over England for many years as queen of the gipsy tribe, she fixed her place of residence at Norwood, about eleven years before her decease. By her constant custom of sitting upon the ground with her chin resting on her knees, generally, by-the-bye, with a pipe in her mouth, attended invariably by a faithful dog, her sinews became so contracted that towards the close of her life she could not extend herself or change her position, so that when she died her corpse was forced to be crammed into a box conformable to her usual posture. It was conveyed in a hearse followed by two mourning coaches to Beckenham churchyard, where she was buried, and a special funeral sermon preached on the occasion. This was in the year 1740. The expense of the funeral was defrayed by the neighbouring publicans, to whom she had been of great service, not from what she drank herself, but from the quantity of people she attracted to the spot by her dexterity in fortune-telling and her wonderful appearance. She was at this time an object of notoriety all over England.

An old inn, called the "Gipsy House," had for a

sign, until the last few years, a portrait of Margaret Finch.

WONDERS IN NATURAL HISTORY.

RECOGNITION OF VOICE BETWEEN THE EWE AND THE LAMB.—James Hogg, "the Ettrick Shepherd," observes, "The acuteness of the sheep's ear surpasses all things in nature that I know of. A ewe will distinguish her own lamb's bleat among a thousand all braying at the same time. Besides, the distinguishing of voice is perfectly reciprocal between the ewe and the lamb, who, amid the deafening sound, run to meet one another. There are few things that have ever amused me more than sheep-shearing; and then the sport continues the whole day. We put the flock into a fold, and set out the ewes to them as they are shorn. The moment that a lamb hears its dam's voice it rushes from the crowd to meet her, but instead of finding the rough, well-clad, comfortable mamma, which it left an hour or a few hours ago, it meets a poor naked starveling—a most deplorable looking creature. It wheels about, and, uttering a loud tremulous bleat of perfect despair, flies from the vision. The mother's voice arrests its flight—it returns, flies, and returns again, generally for ten or a dozen times before the reconcilement is fairly made up."

MUSICAL MICE.—In Brown's "Anecdotes of Quadrupeds" we find the following, given on the authority of Dr. Archer, of Norfolk, in the United States:—"On a rainy evening in 1817 (says the doctor), as I was alone in my chamber, I took up a flute and commenced playing. In a few minutes my attention was directed to a mouse that I saw creeping from a hole, and advancing to the chair in which I was sitting. I ceased playing, and it ran precipitately back to its hole. I began again shortly afterwards, and was much surprised to see it reappear, and take its old position. The appearance of the little animal was truly delightful; it couched itself on the floor, shut its eyes, and appeared in ecstasy. I ceased playing, and it instantly disappeared again. This experiment I repeated frequently with the same success, observing that it was always differently affected, as the music varied from the slow and plaintive to the brisk and lively. It finally went off, and all my art could not entice it to return." A similar and even more remarkable circumstance was communicated to the "Philadelphia Medical and Physical Journal," by Dr. Cramer, of Jefferson County, on the authority of a gentleman of undoubted veracity. He stated that "one evening, as a few officers on board a British man-of-war, in the harbour of Portsmouth, were seated round the fire, one of them began a plaintive air on the violin. He had not performed many minutes when a mouse made its appearance in the centre of the floor. The strange gestures of the little animal strongly excited the attention of the officers, who, with one consent, resolved to suffer it to continue its singular action unmolested. Its exertions appeared to be greater every moment; it shook its head, leaped about, and exhibited signs of the greatest delight. After performing actions which an animal so diminutive would, at first sight, seem incapable of, the little creature, to the astonishment of the spectators, suddenly ceased to move, fell down, and expired without evincing any symptoms of pain." Although these cases are exceptionally striking, the susceptibility of mice to the influence of musical sounds is a well-known fact, and many "performing mice" have been exhibited in public.

REMARKABLE INSCRIPTION.

THE following singular inscription is to be seen carved on a tomb situated at the entrance of the church of San Salvador, in the city of Oviedo. The explanation is that the tomb was erected by a king named Silo, and the inscription is so written that it can be read 270 ways by beginning with the large S in the centre. The words are Latin, "Silo princeps fecit."

T	I	C	E	F	S	P	E	C	N	C	E	P	S	F	E	C	I	T
I	C	E	F	S	P	E	C	N	I	N	C	E	P	S	F	E	C	I
C	E	F	S	P	E	C	N	I	R	I	N	C	E	P	S	F	E	C
E	F	S	P	E	C	N	I	R	P	R	I	N	C	E	P	S	F	E
F	S	P	E	C	N	I	R	P	O	P	R	I	N	C	E	P	S	F
S	P	E	C	N	I	R	P	O	L	O	P	R	I	N	C	E	P	S
P	E	C	N	I	R	P	O	L	I	L	O	P	R	I	N	C	E	P
E	C	N	I	R	P	O	L	I	**S**	I	L	O	P	R	I	N	C	E
P	E	C	N	I	R	P	O	L	I	L	O	P	R	I	N	C	E	P
S	P	E	C	N	I	R	P	O	L	O	P	R	I	N	C	E	P	S
F	S	P	E	C	N	I	R	P	O	P	R	I	N	C	E	P	S	F
E	F	S	P	E	C	N	I	R	P	R	I	N	C	E	P	S	F	E
C	E	F	S	P	E	C	N	I	R	I	N	C	E	P	S	F	E	C
I	C	E	F	S	P	E	C	N	I	N	C	E	P	S	F	E	C	I
T	I	C	E	F	S	P	E	C	N	C	E	P	S	F	E	C	I	T

Besides this singular inscription, the letters H. S. E. S. S. T. T. L. are also carved on the tomb, but

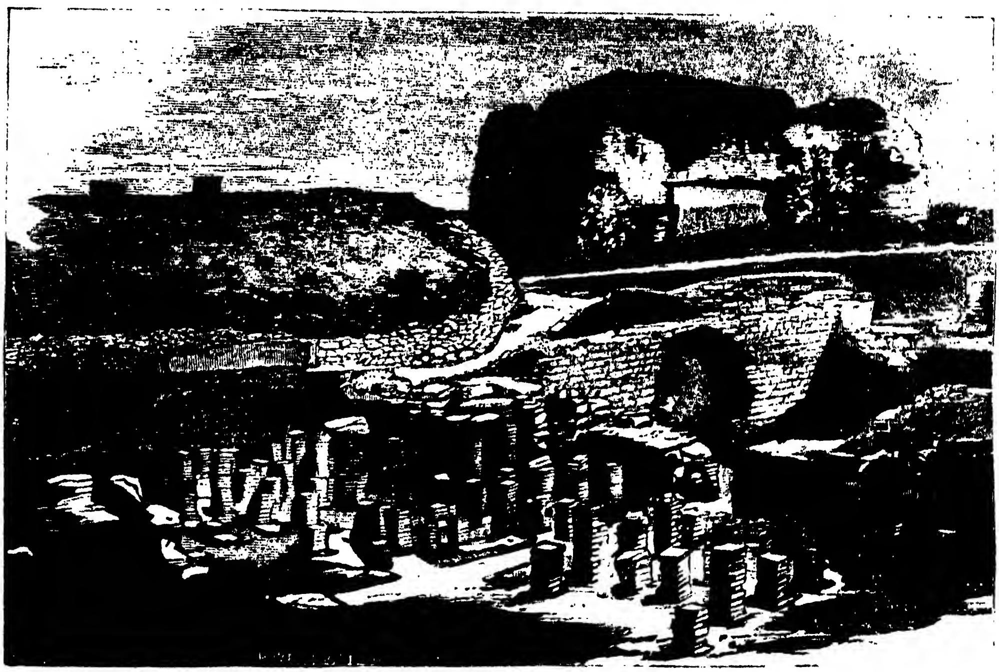
Oviedo, or King of the Asturias, succeeded Aurelius in 774, and died in 785. He was, therefore, a con-
of Charlemagne. No doubt the above inscription was the composition of some ingenious and learned Spanish monk.

Wonderful Relics.

ROMAN CITY IN SHROPSHIRE.

WITHIN the last ten years there have been explored the ruins of the ancient Uriconium, at Wroxeter, a little more than five miles from Shrewsbury; this being the first instance in England of penetrating into a city of more than fourteen centuries ago on so large a scale, and with such extensive remains of its former condition, where the visitor may walk over the floors which had been trodden

last, before they were thus uncovered, by the Roman inhabitants of this island. The city was standing here as early as the beginning of the second century, when it was called Viroconium, a name which appears to have been changed in the later Romano-British period to Uriconium. The line of the ancient town-wall forms an irregular oval more than three miles in circumference, on Watling Street Road, which occupies the line of one of the principal streets of the old city. The only portion of the buildings above ground is a solid mass, upwards of twenty feet high, of Roman large flat red bricks, in long string-courses. and from the end wall of this hypocaust we learn that the Roman houses were plastered and painted externally as well as internally; the exterior wall was painted red, with stripes of yellow. A sort of dust-bin was found filled with coins, hair-pins, fibulæ (brooches), broken pottery and glass, with bones of birds and animals which had been eaten. In another hypocaust were found human remains of three persons who had crept in there for concealment; near one lay a little heap of 132 Roman coins. This, Mr. Thomas Wright, the archæologist, believes, "is the first instance which has occurred in this country in which we have had the opportunity of



VIEW OF EXCAVATIONS IN URICONIUM.

The other remains of the Roman city had long been buried beneath the soil when, in 1859, their excavation was commenced. In one of the plundering invasions of the Picts and Scots, Uriconium is thought to have perished, towards the middle of the fifth century, by fire, when such of the inhabitants as were not massacred were dragged away into captivity.

The old wall already mentioned must have been a portion of a public building; portions of capitals, bases, and shafts of columns were found scattered about; and among other objects were found fragments of a strong iron chain, the head of an axe, and pavements of fine mosaic. This building is thought to have formed the corner of two principal streets of the Roman city. A hypocaust of great size was found, with a quantity of unburnt coal: ascertaining what particular coins, as being then in daily circulation, an inhabitant of a Roman town in Britain, at the moment of the Roman dominion in Britain, carried about with him." The majority of these coins point to the very latest period previous to the establishment of the Anglo-Saxons as the date at which Uriconium must have been destroyed.

Three fine wide streets, the roadway paved with small round stones, were found in Uriconium. The Roman houses in Britain had no upper storeys, all the rooms being on the ground-floor; no traces of a staircase have ever been found. The roofing in Uriconium was of slate or flags. Window-glass was found one-eighth of an inch thick, though until recently it was thought that the Romans, especially in this distant province, did not use window-glass.

Among the domestic articles, two classes of Roman pottery, both evidently made in Shropshire, were found—one white ware, and the other Salopian pottery, among which we find the colander. Most curious is a medicine stamp for salves or washes for the eyes, inscribed with, probably, the name of a physician resident in Uriconium.

The general result of these discoveries is that they show the manner in which this country was inhabited and governed during nearly four centuries; and we learn from the condition of the ruins of Uriconium, and especially from the remains of human beings which are found scattered over its long-deserted floors, the sad fate under which it finally sunk into ruins; and thus we are made vividly acquainted with the character and events of a period of history, which has hitherto been but dimly seen through vague tradition.

A few stones, with Roman inscriptions, chiefly of a sepulchral character, have been dug up at Wroxeter, in the course of accidental excavations. Three of these were found in 1752. One has an inscription intimating that it marked the grave of a soldier of the twentieth legion, which was stationed at Chester, the Roman Deva. Another commemorated a soldier of the fourteenth legion, and is supposed to have belonged to a very early period, as that legion was withdrawn from Britain before A.D. 68. It was the legion which suffered so much in the war against Boadicea, and this soldier may, perhaps, have been engaged in that war, although his having died in Britain does not necessarily imply that the legion to which he had belonged was there at the time, or indeed that it had ever been there, unless we had some other reason for supposing it. The other of these inscribed monuments was divided into three columns, or tables, in memory of three members of the family of a citizen of Uriconium. Another sepulchral stone bears an inscription commemorative of Tiberius Claudius Terentius, a soldier of the cohort of Thracian cavalry. Lastly, is a monument of stone which, during the Middle Ages, had been formed into a holy water stoup, and bears characters which formed part of a Roman inscription to one of the Emperors.

TENACITY OF VEGETABLE LIFE.

THE duration and tenacity of vegetable life, as seen in the length of time during which the seeds of certain plants will retain their vitality, are truly wonderful. We may cite the following as examples.

Lord Lindsay states that in the course of his wanderings amid the pyramids of Egypt he stumbled on a mummy, proved by its hieroglyphics to be at least 2,000 years old. In examining the mummy after it was unwrapped, he found in one of its closed hands a tuberous or bulbous root. He was interested in the question how long vegetable life could last, and he therefore took that tuberous root from the mummy's hand, planted it in a sunny soil, allowed the rains and dews of heaven to descend upon it, and in the course of a few weeks, to his astonishment and joy, the root burst forth and bloomed into a beauteous dahlia.

The roots of many plants retain their vitality under intense temperatures. Those of the *vitex agnus castrus* will not be affected though immersed in boiling water, and boiling water may be applied to many others without their sustaining injury. Certain plants, also, may by their roots absorb some poisons which would be destructive to others.

The seeds on which birds have fed will retain their powers of germination during a long period. Birds that feed on the seed of the castor oil plant have been known to bear them in their bodies from one country to another, where they have grown and multiplied.

THE "GREAT EASTERN" STEAMSHIP.

THE vastness of our sea-going steamships culminates in the *Leviathan* (now the *Great Eastern*), constructed on the wave principle, and lines of Mr. Scott Russell, at Millwall, in 1857, with these dimensions: Length, 680 feet; breadth, 83 feet; depth, 58 feet; tonnage, 23,000 tons; carries of coal and cargo 18,000 tons; nominal horse-power of paddlewheel-engines, 1,000; nominal horse-power of screw-engines, 1,600; draught of water (light), 18 feet; ditto (loaded), 28 feet. The four cylinders of the engines are, probably, the largest steam-cylinders ever made for marine service, at least in England. They are 74 inches in diameter, and have a stroke of 14 feet. Each cylinder is a casting in one piece, weighing 28 tons. The condenser is a casting in one piece, of 36 tons. The upper frames are four castings of 13 tons each, all cast in the works at Millwall without a flaw. The paddle-wheel shafts have Mr. Scott Russell's self-acting gearing, by which engines engage or disengage themselves from either paddle-wheel. Each paddle-wheel is 58 feet in diameter, and in turning one round will advance 60 yards. Two revolutions of the wheel per minute would cover 600 yards per minute, or 36,000 yards per hour, which is a speed of 20 miles an hour for the circumference of the wheel.

The story of the *Great Eastern* is a sad one. This vast ship originally belonged to the Eastern Steam Navigation Company, which had for its chairman the late Mr. Henry Thomas Hope, a member of the wealthy family of that name. The company was established to carry the India and China Mails by the long sea route; but in this they were over-matched by the Peninsular and Oriental Company. In 1854 the ship was commenced by Mr. I. K. Brunel, and nearly a million of money was expended before she was tried. Pecu-

niary difficulties ensued, and in 1858 a new company was formed, with £330,000 capital. In the autumn of 1859 she went to sea; when off Hastings, a destructive accident occurred, and thence followed a series of casualties, but without material injury to her hull or machinery. She rode out a gale in Holyrood Harbour; encountered a hurricane in the Atlantic, which disabled her rudder and damaged her paddles, and left her for three or four days rolling about in the trough of a heavy sea. She ran upon a rock at New York, and broke her bottom-plates for a length of 80 feet, which were repaired while afloat, and without going into dock; she then came home safely. More costly repairs increased her financial difficulties, and eventually the ship was sold for £25,000, scarcely one-third of its value as old materials. The unexpected death of Captain Harrison, the first commander of the *Great Eastern*, should be recorded among the calamities which have befallen this ill-fated vessel.

PASSAGE OF THE EARTH THROUGH THE TAIL OF A COMET.—In June, 1861, M. Liais, the celebrated astronomer at Rio Janeiro, from observations which he had made of the great comet of that year, which had not as yet become visible in Europe, became convinced there was a great likelihood that the earth would come in contact with one of the tails of the comet; and M. Liais proved beyond question, that on the 19th of June, 1861, the earth really did pass through one of the comet's tails, the moment of contact being 12 minutes past 6 a.m.; and the earth must have been *wholly immersed in the tail for about four hours.* Yet it had no perceptible influence upon the weather—a very remarkable fact, adding reason to suppose that cometary matter is some millions of times rarer than our atmosphere. This phenomenon had never before occurred, according to the dictum of Arago the astronomer. Lord Wrottesley, in 1860, remarked that when the comet of Encke returned, its motion was continually accelerated, and it was consequently drawn nearer to the sun. "The final result," says Lord Wrottesley, "will be, that after the lapse of ages, this comet will fall into the sun; this body, a mere hazy cloud, continually flickering, as it were, like a celestial moth round the great luminary, is at some distant period destined to be mercilessly consumed. Professor William Thomson suggests that the heat and light of the sun may be from time to time replenished by the falling in and absorption of countless meteors, which circulate round him; and here we have a cause which may accelerate or produce such an event.

CURIOUS CALCULATION.—The curious in calculations, and readers who have a higher aim, will be interested in the following passage from a paper on "The Physical Constitution of the Sun," by Mr. Brayley. A railway train at the average speed of thirty miles an hour, continuously maintained, would arrive at the moon in eleven months, but would not reach the sun in less than 352 years; so that, if such a train had been started in the year 1512, the third year of the reign of King Henry VIII., it would reach the sun in 1864. When arrived, it would be rather more than a year and a half in reaching the sun's centre; three years and a quarter in passing through the sun, supposing it was tunneled through, and ten years and one-eighth in going round it. How great these dimensions are, may be conceived from the statement, that the same train would attain the centre of the earth in five days and a half, pass through it in eleven days, and go round it in thirty-seven days.

AGED AND CURIOUS TREES.

THE age of trees has ever been a subject of interesting inquiry among naturalists and the lovers of historic illustration. The rings in the trunk, being annually deposited, form a natural chronicle of time, by which the age of a tree is determined with as much precision as the lapse of human events is determined by the contemporaneous registration of annalists. Milton speaks of "monumental oak."

Trees which are known to be of great antiquity sometimes give rise to fabulous legends, destitute of any foundation in fact. Such, for example, was the Plane tree near Caphyæ, in Arcadia, seen by Pausanias in the second century after Christ; which was reported by the inhabitants to have been planted by Menelaus, when he was collecting the army for the expedition against Troy. Such, too, doubtless, was the oak of Mamre, where the angels are said to have appeared to Abraham. A Rose-tree growing in the crypt of the cathedral of Hildesheim is referred, by a church legend, to a date anterior to 1081, which would imply an age of more than 800 years, but the identity is doubtful. Setting aside such doubts, the annals of particular trees are very numerous; and from the best authenticated instances and sources are the following:—

The *Ash* at Carnock, in Stirlingshire, supposed to be the largest in Scotland, and still a luxuriant tree, was planted about the year 1596, by Sir Thomas Nicholson, of Carnock, Lord Advocate of Scotland in the reign of James VI.

The *Baobab tree* is the most wonderful vegetable product of South Africa. Dr. Livingstone describes it as "a great baby-looking bulb," which reaches an enormous size and an astonishing age. It appears, indeed, as if nothing would kill it. The natives make a strong cord from the fibres contained in the pounded bark. The whole of the trunk as far as they can reach is, consequently, barked, which, with

any other tree, would cause its death, but which has no other effect on the Baobab but to make it throw out a new bark. No external injury, not even fire, can destroy this tree from without; and if an axe be driven in with a hard blow, it can with difficulty be extracted from the soft, spongy wood which closes on it. Nor can any injury be done from within, as it is quite common to find the tree hollow; and Dr. Livingstone himself spent a night in one, which was big enough to hold twenty men. Even cutting down does not exterminate it, and it continues to grow in length after it is lying on the ground.

The *Camphor tree* of Sorrogi, in Japan, is hollow, and will hold fifteen persons. It is superstitiously related that it grew from the staff of the philosopher Kobadarsi; and Siebold thinks the tree may have existed since the time of that sage, at the close of the eighth century.

Cypress-trees, on the continent of America, grow to immense ages. In counting the concentric rings in sawing a trunk across, it appears that 1,600 years is a common age. There is a gigantic trunk in the province of Oxaca, in Mexico, whose circumference at the base is 200 feet; of this, taking 1·6 line as the average growth of a year, the age would be 3,512 years (Lyell's "United States" and Prescott's "Peru"). The *cypress of Soma*, in Lombardy, is reputed to be the oldest tree of which there is any record in the world. It is generally supposed to have been planted in the year of the birth of Christ; but the Abbé Belize says there is extant at Milan a chronicle which proves that it was a tree in the time of Julius Cæsar, B.C. 42. It is 121 feet high. Evelyn, in his "Sylva," mentions a gigantic cypress in Persia, but his calculation of its age at 2,500 years is considered of no value. The cypress of Hafiz, near Shiraz, is said to have been planted by the poet himself.

The *Dragon tree*, of Orotava, in the island of Teneriffe, was considered by Humboldt to be 1,000 years old. It is stated to have been as large and as hollow in 1402 as it was found by Humboldt in the last century. In 1819 a storm deprived this tree of part of its crown, and it was entirely destroyed in the autumn of 1867 by a gale of wind.

A *great Elm*, growing at Chipstead Place, in Kent, in appearance bears out the tradition annexed to it, that in the time of Henry V. a fair was held annually under its branches—the high road from Rye, in Sussex, to London then passing close by it. If this tradition be authentic, the elm in question must have been a large and well-spreading tree in the years 1413—22. An elm at Chequers, in Buckinghamshire, is reported, by a tradition handed down in the families of the successive owners, to have been planted in the reign of King Stephen.

The *Eucalyptus* or *Gum-tree*, near the foot of Mount Wellington, in Tasmania, is stated to be 250 feet high; its diameter is fully thirty feet. This is reputed to be the largest, if not the oldest, tree in the world.

A *Fir tree*, near Mont Blanc, has been ascertained by M. Bertholet to be more than 1,200 years old; and near it, in the Forest of Ferré, is a tree called the Meleye, whose age cannot be less than 800 years. A silver fir grew near Barr; a section of its trunk is preserved in the Museum at Strasburg. Its diameter was eight feet close to the ground, and the number of rings is said to amount to several hundreds.

The *Hethel Thorn* was said by the first Sir Thomas Beevor to be mentioned in a deed of 1200 and odd as a boundary, under the appellation of "the Old Thorn.' It is stated also to be mentioned in some chronicle as *the thorn* round which a meeting of insurgent peasantry was held during the reign of King John. The involution of its branches, which are all hollow tubes, as heavy as iron, is most curious.

A *Lime tree* at Neustadt, in Wirtemberg, is said to be 1,000 years old. A German writer states it to have required the support of sixty pillars in the year 1392, and attained its present size in 1541; it now rests on 100 props, and a market can be held under its shade. There is another colossal lime in the churchyard of the village of Cadiz, near Dresden. The trunk is forty feet in circumference, and is completely hollow. There is also at Freyburg, in Switzerland, a lime tree which was planted in remembrance of the battle of Morat, fought June 27th, 1476.

The *Olive tree* at Pessio, the most ancient in Italy, is stated by Masechettini to be 700 years old; but in the environs of Nice is an olive tree of much greater age.

Orange trees.—In the orangery at Versailles is a tree raised from seed sown in 1421. There is another in the yard of the convent of St. Sabina, at Rome, said to have been planted by St. Dominic, in 1200. In the neighbourhood of Finale is an orange tree which bears nearly 8,000 oranges in a single year. There are in Holland many orange trees which have been in the same family 200 and 300 years; one at Versailles has the inscription, "Semé en 1421."

The *Tree of the Thousand Images*, seen by Father Huc in his journey to Thibet, has its leaves and bark covered with well-defined characters of the Thibetian alphabet. It appeared to MM. Huc and Gabet to be of great age, and is said by the inhabitants of the country to be the only one of its kind known there. According to the account given by these travellers, the letters would appear to be formed of the veins of the leaves. The resemblance to Thibetian characters induced them to suspect fraud; but, after repeated observations, they came to the conclusion that no fraud existed.

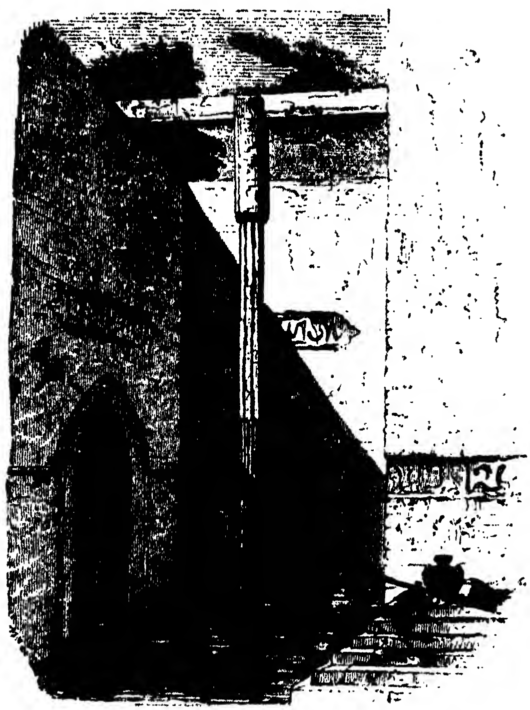
THE RISING OF THE NILE.

To the annual phenomenon of the rising of the Nile, Egypt is entirely indebted for its fertility, and even for its existence as an inhabited and populous country. Without it the land would always have been a desert, incapable of affording the means of subsistence to man. Except occasionally near the shores of the Mediterranean, no rain falls throughout the land, and therefore its parched and sandy soil would be entirely unfruitful, were it not that regularly, at a certain season of the year, the river overflows the whole adjacent country.

Why it should do so was a mystery in ancient times, and many absurd theories and conjectures were raised to account for it. The Egyptians themselves believed the river was a god, who in his beneficence spread himself annually over the land, to supply the wants of his people. If the rising did not begin to make its appearance at the expected time—and it has hardly varied a single day throughout the course of ages—they hastily prepared a sacrifice to this deity, usually a beautiful girl, who was richly adorned, and then thrown into the stream.

Some of the ancient philosophers lighted on the true reason of the rising of the waters, when they imagined it to be due to heavy rains falling in the interior of Africa, and swelling the sources of the river. What those sources were, it had baffled the investigation of thousands of years to ascertain, until recently our travellers, Speke, Grant, and Baker, discovered them in immense lakes situated near the equator, more than 3,000 miles, as the stream winds, from the mouth of the Nile on the Mediterranean coast. To these lakes the names of the Victoria Nyanza and the Albert Nyanza have been given by the successful explorers.

In the regions adjacent to these lakes, rain falls throughout the greater part of the year, and most heavily in March, at the time of the spring equinox. The lakes form huge reservoirs for the water which descends from the elevations known as the Mountains of the Moon; and as they become swollen, the size of the streams which emerge from them is proportionately increased. Several of these streams uniting in their course form the Upper or White Nile, and this river, flowing gradually on until it meets the Blue or Lower Nile, bears irrigation to the thirsty lands below. Not only this, but as these rivers come down they bring with them a quantity of alluvial soil of the richest kind; and when the Nile at last spreads itself over the flat and sandy plains of Egypt, it enriches them year by year with this muddy but fertile deposit. The consequence is a gradual rising of the land, to the extent, it is calculated, of from five to six inches in a century. Owing to this fact, many of the remains of the proudest cities of ancient Egypt are now half buried in the soil.



THE NILOMETER.

Although in these days we know more about natural phenomena than the philosophers of old, and can satisfactorily explain the reason of the rising of the waters, there remains one wonder connected with it which is as great to us as to them, and that is its uniformity. As we have said, throughout the course of ages its commencement has scarcely varied by one day, and its extent is also comprised, as a rule, within a narrow limit. So equal, in the main, must be the quantity of water which falls annually at the equator, and so regular the commencement and decline of the rainy season.

The rising commences in Lower Egypt about the 25th of June, and steadily increases during the three months following. In this time the valley of the Nile becomes covered by its waters, and its villages stand out from them like little islands, as for the time they are. When the water has attained its maximum height, it remains stationary for about ten days, and then declines as steadily as it arose. On its subsiding, the land has been thoroughly fertilised, and vegetation becomes luxuriant.

The height to which the river rises is a matter of vital importance. A few feet more or less make the difference between starvation and abundance.

The average height varies according to the distance traversed by the river, from about forty feet where it enters Egypt, to four feet only near the Mediterranean. Taking as an intermediate height that observed at Cairo, if the rise is less than twenty feet, there is scarcity, or even famine; if it is three or four feet more, the crops will be short; three or four feet more again, and they will be abundant; but if the water goes still higher, it becomes an unhealthy flood.

Contrivances for measuring the exact rise of the Nile were in use in ancient times, and in two instances the remains of these "Nilometers" still exist. One, and the most ancient, supposed to have been erected in the time of the Roman dominion, is found in the island of Elephantine, in Upper Egypt; and on the walls of the building in which it is contained are inscriptions recording the heights of the inundation in various years. The other (represented in our engraving) is situated in the island of Rhoda, near Cairo, and is believed to have been built in the time of the Arabian caliphs. It consists of a square well, into which the water is admitted as it rises, while in the centre is a column of marble marked at frequent intervals with the distance from the lowest level. The Nilometers are supposed to have been of chief utility in adjusting the taxation of the country, as they would give indications as to whether the season would be plentiful or otherwise.

WONDERS OF PHOTOGRAPHY.

AKIN to the "Magic Photographs" mentioned in a previous number, are Dr. Taylor's Dioramic Photographs, first exhibited about seven years ago, and described in a Glasgow newspaper. For example, we are looking through the glass at an Indian river scène. The glow of a tropical sun is gleaming in the sky and in the waters, but as we look the scene changes. The clouds which had previously seemed to hang in the tropical sky, appear to move and to assume a dusky hue, the waters look sombre, the landscape begins to wear a deeper green, gradually the light dies away, and there remains the cool and quiet of an evening on the banks of the Ganges or the Hooghly. This, again, like the invisible photograph, is but the application, with the additional artistic effects afforded by photography, and other improved means, of an old principle. The apparatus employed is a revolving cylinder, the edge or rim of which is strongly coloured with the required hues, which are reflected upon the photographic plates according to the effect required.

Next to the above in curious interest, is what may be called Microscopic Photography, or the reduction of large objects into such small dimensions that the picture is invisible to the naked eye. Mr. Shadbolt, in 1854, was the first who executed these small photographs by making an achromatic object-glass 1 or 1½ in. focus the lens of a camera, and using a peculiar kind of collodion. His portraits varied from $\frac{1}{30}$th to $\frac{1}{40}$th of an inch in diameter, and would bear to be magnified a hundred times. Mr. Dancer, of Manchester, produced a family group of *seven full-length photographs* in a spot the size of a pin's head; and he states that it is only a question of trouble to include 10,000 portraits in a square inch. Ten years ago it was suggested that a diplomatic despatch might be conveyed in a spot no bigger than a full stop. Since that time the idea has been worked out in a variety of ways, a full page of the *Times* newspaper or an extensive landscape, having been photographed in so small a space.

The enlargement of photographs, though less wonderful to the common apprehension than their reduction to the infinitely small, is, practically, not less interesting and curious. These enlarged pictures were first exhibited by M. Claudet at the soirée of the British Association in 1862. By means of the solar camera, photographic cartes were magnified to the size of life. The effect, when first seen, was pronounced very striking and beautiful. M. Claudet, at the same time, also exhibited some photographs taken by the Count de Montizon of all the most curious animals of the Zoological Gardens, and instantaneous views of Paris by Ferrier, showing the boulevards full of carriages and people, as they are in the middle of the day.

But the most striking photographs of this topographical character are those which have been taken in balloons floating some 4,000 feet above the earth. The first experiments of this kind were made by Mr. Negretti in Coxwell's "Mammoth" balloon in the summer of 1863. They were regarded with much interest at the time, as several problems were involved in success or failure—such, for example, as the difficulty of operating at all in a moving tent, and the question whether the actinic power of the solar rays would be as effective up aloft as on the surface of the earth. It was not only the onward motion of the balloon that created a difficulty, but its *rotating* motion, to obviate which a good deal of ingenuity in constructing and working the apparatus was needful.

One more of the surprising effects of photography remains to be mentioned here—viz., its application to illustrate geometrical figures and problems. This followed rapidly upon the discovery of the principle of the stereoscope. Every one who has gone through the eleventh book of Euclid is aware of the great difficulty which is superadded to that of the problem itself by the number of lines crossing each other on a flat surface. By producing these lines on stereoscopic slides, they are made to appear

as if the figure was made of wires stretching from point to point in space. Planes are seen to intersect each other with as much distinctness as if they were sheets of cardboard inclined at various angles; and solid angles and pyramids have their edges and angular points in such tangible relief that a model could not afford a better illustration of the text. The letters, too, are so contrived as to appear to belong to the points to which they refer, and to stand out at the proper distances from the spectator.

Before concluding this article we may also notice some remarkable instances of grotesque or caricature photography. When the lamented Abraham Lincoln was president of the United States, his photographic portrait was exhibited, and to the naked eye appeared as if pitted with the small-pox. On examining the dots with a microscope, they were found to consist of portraits of generals, politicians, divines, poets, actresses, and other well-known characters suitably placed. Jeff. Davis would be found in the president's eye; McClellan on the tip of his nose; Miss Cushman, or some other sweet thing, on his lips, and so on. All these likenesses were said to be very striking, and the whole caricature was regarded as a felicitous performance. Something of the same comic character was done in Rome, when well-known figures, suggestive of a satirical application, were published with the heads of public characters. Thus the face of Antonelli appeared on the shoulders of Fra Diavolo; and the queen of Naples was made to figure as Moll Flagon. Even the Pope himself was not spared. The speedy result, however, was a Papal edict against the enormity, by which the photographic artists were subjected to the loss of their places and instruments, a fine of one hundred dollars, and a year in the galleys! The models who dared to sit for such figures were denounced in the same penalties.

Wonderful Relics.

Prices Realised by Relics.—The passion for the possession of remarkable relics has led to extraordinary prices being sometimes given for things of little value in themselves, or sometimes perfectly worthless. The following instances of extravagant sums paid for objects more or less curious have been recorded:—A tooth of Sir Isaac Newton's was sold in 1816 for the sum of £730. It was purchased by a nobleman, who had it set in a ring which he wore constantly on his finger.

The prayer-book used by King Charles I. when on the scaffold was sold in London in 1825 for 100 guineas.

The hat worn by Napoleon Bonaparte, at the battle of Eylau, was sold in Paris, in 1835, for 1,920 francs (about £80). It was put up for sale at 500 francs, and there were thirty-two bidders.

The ivory arm-chair presented to Gustavus Vasa by the city of Lubeck was sold, in 1825, to the Swedish chamberlain, M. Schmekel, for 58,000 florins.

The coat worn by Charles XII. at the battle of Pultawa, and preserved by one of his officers and attendants, was sold in 1825 for 561,000 francs.

The two pens employed in signing the treaty of Amiens were sold in 1825 for £500.

The pens used in Paris for signing the treaty of peace, concluded after the Russian war, were presented to the Empress Eugenie, by whom they have no doubt been carefully preserved.

A wig that had belonged to Sterne was sold at a public auction in London for 200 guineas.

An old wig which had belonged to the German philosopher, Kant, was sold after his death for 200 francs.

Voltaire's cane realised 500 francs at a sale in Paris.

A waistcoat belonging to J. J. Rousseau was sold for 950 francs, and his metal watch for 500 francs.

At the French village of Pezenas some years ago there was an old arm-chair, which was said to have been frequently used by Molière. When he was living in this village he was accustomed every Saturday afternoon to go to a barber's shop, in a corner of which this chair was kept. The shop was the resort of all the idlers and gossips of the town, and there politics were discussed, and all the news of the day repeated. The chair in the corner formed a kind of observatory for the dramatist, who was in the habit of attentively watching all that was going on around him. The old chair was brought to Paris to be sold, and realised a considerable sum.

The Harp of Brian Boru.—The great Irish monarch, Brian Boroihme, or Boru, was killed at the battle of Clontarf, A.D. 1014. He left his son, Donagh, his harp, but Donagh having murdered his brother and been deposed by his nephew, retired to Rome, and carried with him the crown, harp, and regalia of his father. These regalia were kept in the Vatican till Pope Clement sent the harp to Henry VIII., but kept the crown, which was of massive gold. Henry gave the harp to the first Earl of Clanricarde, in whose family it remained until the beginning of the eighteenth century, when it passed by marriage into other hands. It was deposited in 1782 in the Museum of Trinity College, Dublin, where it now is. The harp is thirty-two inches high, and of good workmanship, the sounding-board is of oak, and the extremity of the uppermost arm is capped in part with silver, well wrought and chiselled. It contains a large crystal set in silver, and under it was another stone, now lost.

GLACIERS.

GLACIERS are masses of ice which descend into the valleys from the higher regions of snow-mountains. Above a certain line, called the snow-line, varying in height according to the situation of the country—in the Alps it is on an average at 7,200 feet above the sea level—the sun is not sufficiently powerful to melt the snow that falls in large quantities during the winter months. In the recesses and higher valleys of the mountains this snow accumulates, one layer being formed upon another, till the lower strata, by the increasing weight above, become pressed and consolidated together till they form ice; and the whole mass is then forced down the valley till it reaches and extends beyond the snow-line. If the reservoir above is small, the portion that arrives beyond the snow-line melts, the supply equalling the demand and no more. But in large mountainous districts, where the accumulations are on a vaster scale, the supply exceeds the demand, and the ice is gradually pressed down into the lower valleys, and often into the plains.

"The glacier's cold and restless mass
Moves onward day by day:

but its rate of progress varies very much, being naturally quicker in summer and slower in the winter. The progress of the Mer de Glace has been as much as thirty inches a day in summer, and sixteen inches in winter.

M. Agassiz was the first to ascertain by exact measurements the rate of progress of a glacier. By boring holes in the ice, and fixing in them piles of wood in the same straight line across the glacier, and opposite to certain marked objects on the sides of the mountain, he was enabled, by returning to the same spot the next year, to determine how far downwards the piles had moved.

Glaciers abound in all the great mountain chains, and play an important part in physical geography, being the sources of some of the largest rivers in Europe and Asia. The Rhine, the Po, the Rhone, the Garonne, the Ganges, and the Indus, all take their rise from glacier streams. Some glaciers cover an enormous area; that of Baltoro, in the Himalayas, is as much as thirty-six miles long, and between two and three miles wide; that of Biafo is sixty-four miles long. The glaciers of the Alps are better known, and though small when compared to those just quoted, are yet of considerable extent and importance. There are as many as sixty in the whole Alpine range, which extends from Mont Pelvoux, in Dauphiné, to the Grosser Glockner, in Carinthia. The glacier of Aletsch, the largest in Switzerland, is sixteen miles long and one and a quarter miles broad, and descends from 12,000 to 4,000 feet above the sea. The Mer de Glace, which descends into the valley of Chamouni, one of the best known of all glaciers, is seven and a half miles long.

Fig. 1.—THE RHONE GLACIER.

The glacier of the Rhone, shown in the illustration, gives a very good specimen of the general features of a glacier, and more especially of what is called the fan-shaped glacier. It takes its rise on the west side of the Galenstock—the mountain on the right of the picture—and after issuing through a somewhat narrow portal, extends itself, comparatively unconfined, over the slope of the mountain. It expands in a nearly circular shape; and the deep fissures or crevasses, as they are called, formed by the onward motion of the ice, appear, like the sticks of a fan, to radiate from the centre. From the valley, the upper part of the glacier or *nevé* is seen piled up in a confused mass, broken and cracked by the action of the weather, and assuming strange fantastic shapes. These blocks are known by the name of *séracs*. The lower part, as may be seen, is comparatively flat, and may be traversed easily, though the crevasses are rather wide. These crevasses are generally filled with water, of a dark blue colour, within a few feet of the surface, and are often of great extent, and form the real dangers of mountain travelling. A crevasse on the Mer de Glace was estimated at 2,000 feet in length. It is in this part of the glacier that are found the internal cascades or *moulins*, as they are called. They arise from the superficial water occasioned by rains, and the melting of the snow on the surface. The several small rivulets formed from these causes unite in one considerable stream, which flows on till it comes at last to a crevasse, down which it descends in great force, keeping open and widening the channel, which presents at length an open shaft sometimes of immense depth. There is a *moulin* on the Mer de Glace more than 350 feet deep. On the right bank of the Rhone glacier, where the glacier meets the rock, is a very fine specimen of this ice waterfall. Sometimes, when the bed of a glacier is high, and breaks off abruptly, the ice is forced over the precipice thus formed in huge blocks, and constitutes an ice-fall; one of the most singular phenomena of the mountains. There is a very fine ice-fall in the lower glacier at Grindelwald, and one in the Mer de Glace.

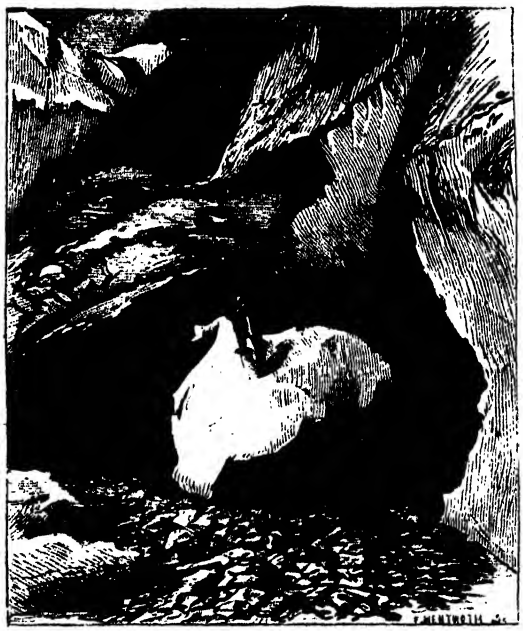


Fig. 2. GLACIER CAVERN.

The lower end of a glacier is usually steep. Sometimes its outline rises unbroken, but more frequently it is split up, by intersecting cracks, into masses, which the continued action of the sun and air sharpen into pyramids and grotesque shapes. The stream formed by the waste and melting of the ice, and fed by the *moulins*, issues at the foot of the glacier, sometimes by a small opening, but generally from a cave, as in Fig. 2. In the summertime, after heavy rains, the snow and ice at these apertures are loosened, and fall in large quantities, widening the entrances of these outlets. The effect on these ice-caves, when the sun is shining, is singularly beautiful, the dirty masses of the outer crust contrasting with the pure white of the inner layers, and the glitter of the blue and green ice.

The heaps of débris depicted in the foreground of Fig. 1 are called *moraines*. They consist of rock and pieces of stone and earth brought away by the glacier in the course of its journey down the mountain. All along the sides of a glacier these heaps may be seen, and wherever they are found it is a sure sign that a glacier has been there some time or other. For a glacier recedes as well as advances, and its path, like that of a retreating army, may be traced by the ravages it has committed and the ruins it leaves behind. There is little doubt that the glacier of the Rhone once extended to the Lake of Geneva. Another sure sign of the track of a glacier is its action on the bed of rock on which it is formed. Stones and pieces of rock find their way through the crevasses to the bed of the glacier stream. These, by the immense weight above, are ground into a species of powerful emery powder, and wear away the surface of the hardest rock, rounding off huge blocks as smooth as a slab of marble. The stones and rocks in their turn are ground into powder, and a glacier stream can always be recognised by its white milky colour, caused by these ground atoms. The peculiarities of form produced by this grinding action of the ice are to be traced in most of the Alpine valleys. In the Grimsel and Hasli valleys, on the slopes of the Jura and the Italian sides of the Alps, evidences of extinct glaciers are to be found in every direction, and they are not confined to high mountainous districts only, but are to be seen in the hills of

Cumberland, Wales, Scotland, and Ireland. Round Snowdon especially, the rocks are furrowed and scratched by glacier action; and there is reliable evidence that the ground now occupied by the Lake of Killarney, was once a glacier bed.

WONDERFUL DEXTERITY OF A GOAT.

Dr. Clarke relates that when he was travelling from Jerusalem to Bethlehem, his party fell in with an Arab who had a goat, which he led about the country for exhibition. He had taught this animal, while he accompanied its movements with a song, to mount upon little cylindrical blocks of wood, placed successively one above the other, and in shape resembling the dice-boxes of a backgammon table. In this manner the goat stood first upon the top of one cylinder, then upon the top of two, and afterwards of three, four, five, and six, until it remained balanced upon the top of them all, elevated several feet from the ground, and with its four feet collected on a single point, without throwing down the disjointed fabric upon which it stood. Dr. Clarke adds, that this feat is very ancient. It is also noticed by Sandys. Nothing can show more strikingly the tenacious footing possessed by this quadruped upon the jutting points and crags of rocks; and the circumstance of its ability to remain thus poised may render this exhibition less surprising. It is seen frequently in mountainous countries, standing securely, though with hardly any place for its feet, upon the sides and by the brink of the most tremendous precipices. The diameter of the upper cylinder upon which its feet ultimately remained until the Arab had ended his ditty was only two inches, and the length of each cylinder was six inches. The most curious part of the performance occurred afterwards; for the Arab, to convince Dr. Clarke's party of the goat's attention to his tune, interrupted the *da capo*. As often as he did this the goat tottered, appeared uneasy, and upon his master becoming suddenly silent in the middle of the song, fell to the ground.

THE COLOSSUS OF RHODES.

In the days of its prosperity, the capital of the island of Rhodes—"the City of the Sun," as it was poetically called—is said to have been adorned with 3,000 statues and upwards of 100 colossal figures; of the latter, one was distinguished as "the Colossus of Rhodes," which was one of the Seven Wonders of the World. It was erected with the spoil which Demetrius left behind him when he raised the siege which he had so long carried on against the city, and the statue was consecrated to the Sun, the tutelar deity of Rhodes. It was, according to Pliny, the work of Chares of Lindus, a pupil of Lysippus. Its height was twenty cubits (about 105 feet), the cost of its erection amounted to 300 talents (about £70,000), and the time consumed in its construction was twelve years. Fifty-six years after its completion (224 B.C.), this stupendous statue was thrown down by an earthquake; and in Pliny's time, it was still lying on the ground, a wonder to behold. Few persons, he says, could embrace the thumbs, and the fingers were longer than the bodies of most statues; through the fractures were seen huge cavities, into which immense stones had been placed to balance it while standing. It is asserted to have spanned the entrance to the harbour of the island, and to have admitted the passage of vessels in full sail between its wide-stretched legs; and, although no old representation of the statue exists, the historian Rollin, several French dictionaries, and even encyclopædists have adopted the above description of the wonder. Vignere is supposed to have been the first who ventured to make an imaginary drawing of the Colossus. Chevreau added a lamp to the right hand of the statue. Du Choul further adorned the Colossus by giving him a sword and lance, and by hanging a mirror round his neck, "in which," it is added, "ships might be discovered as far off as the coast of Egypt."

The Count Gouffier, about the year 1780, however, declared the Colossus with the outstretched legs to be fabulous, as did the Belgian Colonel Rottiers, and our geologist Hamilton; but they placed the statue at the entrance to one of the smaller harbours of Rhodes scarcely forty feet wide. "Rottiers," says Delepierre, in his "Historical Difficulties," published in 1868, "goes even further, and gives a superb engraving of the Colossus, under the form of an Apollo, the bow and quiver upon his shoulders, his forehead encircled by rays of light, and a beacon-flame above his head." The statue, according to Delepierre, was erected on an open space of ground near the great harbour, and close to the spot where the pacha's seraglio now stands. This explanation is still further supported by the fact, that a chapel built on the ground, in the time of the Templars, is named *Fanum Sancti Joannis Colossensis*.

Strabo, who wrote and travelled during the reigns of the first two Roman emperors, is, after Polybius, the earliest author who mentions the fall of the Colossus. Pliny enters into fuller details. Towards the end of the second century after Christ, some writers speak of a colossal statue at Rhodes as still existing, and Delepierre thinks it possible that "one was again constructed, but of smaller dimensions. Indeed, Les Allazzi tells us that the Colossus of Rhodes was reconstructed under the Emperor Vespasian." And, a long time after the fall of the Roman empire, the island of Rhodes was conquered by the general-in-chief of the Caliph

Othman, in the seventh century of the Christian era, when, we are told in Byzantine history, that "the general took down the Colossus which stood erect on the island, transported the metal into Syria, and sold it to a Jew, who loaded 980 camels with the materials of his purchase," which statement disposes of the story, that after the overthrow of the Colossus, Greece and Egypt offered to contribute large sums to restore the figure; but the Rhodians declined, alleging that they were forbidden by an oracle to do so. We perceive that Delepierre is inclined to attribute the exaggerated stories of the Colossus to the time of the Crusades, when the inhabitants of Rhodes made this boast to the new comers of their past grandeurs.

Wonderful Statistics.

ORIENTAL WEALTH: TIPPOO SULTAN.—In 1786, after Tippoo had concluded an expensive war with the English, his treasures were thus estimated: —80,000,000 sterling (jewels and treasures); 700 elephants; 6,000 camels; 11,000 horses; 400,000 bullocks and cows; 100,000 buffaloes; 600,000 sheep; besides immense quantities of military stores and arms.—*Memoirs and Correspondence of Marquis Wellesley*, vol. i., p. 195.

THE RAILWAY MANIA IN 1845.—In 1845, there were before the public projects for railways, 620 in number, requiring a capital of £563,203,000. Parliament granted powers to make 2,883 miles of railway, at a cost of 44 millions. In 1846 applications were made to Parliament for powers to raise 389 millions sterling for new lines; and powers were granted for forming 4,790 miles (including 60 miles of tunnel), at a cost of 120 millions sterling.—*Smiles'* "*Life of George Stephenson*," p. 419.

CURIOSITIES OF PICTURE DEALING.—The Orleans Gallery of the Italian and French schools, containing 295 pictures, was sold by its owner, Philip Egalité, in 1792, to Mr. Walkners, a banker at Brussels, for 750,000 francs. He in turn sold them to M. Laborde de Mereville, for 900,000 francs (£36,000). The next owner was Mr. Jeremiah Harmann, of London, who gave £40,000 for them. In 1798, the Duke of Bridgewater, Earl of Gower, and Earl of Carlisle bought them for £41,000, selected for themselves pictures of the estimated value of £39,000, and then realised by a private sale of others, 31,000 guineas, and by auction of the remainder, £10,000; thus obtaining for nothing pictures valued at £39,000.—*Waagen's* "*Art Treasures in England*," vol. i., p. 21. Waagen also mentions (ibid., vol. i., p. 408) a picture by Cuyp, in Sir Robert Peel's collection, on panel (1 foot by 1 foot 8 inches) a landscape, originally purchased at Hoorn, in Holland, for about one shilling English. Sir Robert Peel paid 350 guineas for it.

WONDERFUL EFFECT OF IMAGINATION.

DURING the siege of Breda, in the Netherlands, in 1625, the garrison was dreadfully afflicted with the scurvy. So useless was the medical aid afforded to the soldiers, and so desperate were they in consequence, that they resolved to give up the city to the enemy. This resolution came to the ears of the Prince of Orange; he immediately wrote addresses to the men, assuring them that he possessed remedies that were unknown to physicians, and that he would undertake their cure, provided they continued in the discharge of their duty. Together with these addresses he sent to the physicians small vials of coloured water, which the patients were assured were of immense price, and of unspeakable virtue. Many, who declared that all former remedies had only made them worse, now recovered in a few days. A long and interesting account of the wonderful working of this purely imaginary antidote was drawn up by M. Van der Mye, one of the physicians in the garrison, whose office was thus successfully usurped by the Prince of Orange. A corroborative proof of the well-known power of the imagination in affecting disease is afforded in the following Arabian fable:—One day a traveller met the Plague going into Cairo, and accosted it thus: "For what purpose are you entering Cairo?" "To kill 3,000 people," rejoined the Plague. Some time after, the same traveller met the Plague on his return, and said, "But you killed 30,000!" "Nay," replied the Plague, "I killed but 3,000; the rest died of fright."

THE ALEXANDRIAN LIBRARY.

THIS celebrated collection of books was founded by the first Ptolemy, king of Egypt, and was maintained by him and his successors; its foundation dates between 285 and 283 B.C., and it was suggested by Demetrius Phalareus, who had seen and profited by public libraries at Athens. Demetrius was appointed superintendent of the new library, and collected for it the literature of all nations, Jewish, Chaldee, Persian, Ethiopian, Egyptian, &c., as well as Greek and Latin. This was, probably, the largest collection of books which was ever brought together before the invention of printing, and from this circumstance thus early the city of Alexandria derived the title of "Mother of Books."

The number of books in the library has been variously stated. Some authors assert that Demetrius had brought together 200,000 volumes; but Eusebius says, with more probability, that at the death of Ptolemy Philadelphus, which occurred later, there were but 100,000 volumes in the library. Philadelphus purchased the library of Aristotle.

His successor, Ptolemy Euergetes, greatly increased the library. In the reign of Ptolemy Epiphanes, Eumenes, king of Pergamos, established a rival library. The Egyptian monarch, in a fit of jealousy, forbade the exportation of paper (*papyrus*) from his domains; and the invention of parchment, or, perhaps, the improvement of this material, was the consequence. Ptolemy (Euergetes II.) was also a great book collector, and is said to have commenced a second library, probably that which was placed in the Serapeion, or temple of Serapis, in a different quarter of the city. It is said that during his reign all books brought into Egypt were seized and sent to the museum, as it was called, where they were transcribed, and the copies delivered to the owners, while the originals were detained in the library—a royal road to the formation of a valuable collection. Almost all the Ptolemies were patrons of learning; and at last the Alexandrian Library is said to have amounted to 700,000 volumes. It is to be recollected that the rolls (*volumina*) spoken of contained far less than a printed volume, as, for instance, the "Metamorphoses" of Ovid, in fifteen books, would make fifteen volumes; and one Didymus is said by Athenaeus to have written 3,500 volumes. This consideration will bring the number assigned at least within the bounds of credibility.

The library building was eastward of the sea-port of Alexandria, and in its siege by Julius Cæsar, when he set fire to the fleet, the flames were carried by the wind to the neighbouring houses, and thence to the library; and the conflagration is thus vividly described in Rowe's translation of the "Pharsalia" of Lucan:—

'On one proud side the lofty fabr
old into the adjoining flood;
, fill'd with armed bands, their barks drew near
d the same defending Cæsar there:
To every part the ready warrior flies,
And with new rage the fainting fight supplies:
Headlong he drives them with his deadly blade,
Nor seems to be invaded, but to invade.
Against the ships Phalaric darts he aims,
Each dart with pitch and livid sulphur flames.
The spreading fire o'erruns their unctuous sides,
And nimbly mounting, on the topmast rides.
Planks, yards, and cordage feed the dreadful blaze;
The drowning vessel hisses in the seas;
While floating arms and men promiscuous strew'd,
Hide the whole surface of the azure flood.
Nor dwells destruction on their fleet alone,
But, driven by winds, invades the neighbouring town:
On rapid wings the sheety flames they bear,

Not much unlike the shooting meteors fly
In gleaming trails athwart the midnight sky.
Soon as the crowd behold their city burn,
Thither, all headlong, from the siege they turn
But Cæsar, prone to vigilance and haste,
To snatch the just occasion ere it pass'd,
Hid in the friendly night's involving shade,
A safe retreat to Pharos timely made.

The library of the Serapeion is said also to have been burnt in this siege, but this has been disputed. If burnt, it was, at least, very soon re-established; and there is reason to presume that the diligence of the learned men who frequented and were attached to these establishments, would preserve some part of their contents, to aid in forming the new library, to which Marc Antony presented, through Cleopatra, the whole collection of Eumenes, king of Pergamos, amounting to 200,000 volumes. Gibbon asserts that the whole library was totally consumed, and that this gift was the foundation of the new one, which continued to increase in size and reputation for four centuries, until, at the destruction of the Serapeion by Theophilus, Patriarch of Alexandria, it was dispersed, A.D. 390. Orosius, who visited the place twenty years afterwards, saw the empty book-cases. Still the library was re-established; and Alexandria continued to flourish as one of the chief seats of literature until it was conquered by the Arabs, A.D. 640. The library was then burnt, according to the story generally believed, in consequence of the fanatic decision of the Caliph Omar, "If these writings of the Greeks agree with the Book of God (the Koran), they are useless, and need not be preserved; if they disagree, they are pernicious, and ought to be destroyed." Accordingly, it is said, the books were distributed to the various baths in Alexandria, to be burnt in the stoves; and such was the number, that six months were barely sufficient for the consumption of the precious fuel. Gibbon, and other writers, reject this notion. Delepierre objects that John of Alexandria, who figures in the story, was dead before the city was taken in 640. Then there were 4,000 baths in Alexandria to be heated. Greek authors, who were so incensed against the Saracens, omit to speak of this conflagration authorised by Omar; and "the caliphs had forbidden, under severe penalties, the destruction of all Jewish and Christian volumes; and we nowhere hear of any such work of destruction during the first conquests of the Mohammedans," although two Orientalists, Langley and De Sacy, maintain that the Mohammedans did demolish libraries and destroy books, in spite of the law against any such destruction.

Gibbon thus pathetically describes the empty library at Alexandria: "It was pillaged or destroyed; and near twenty years afterwards the appearance of the *empty shelves* excited the regret and indignation of every spectator whose mind was not totally darkened by religious prejudice. The compositions of ancient genius, so many of which have irrevocably perished, might surely have been excepted from the wreck of idolatry, for the amusement and instruction of succeeding ages; and either the zeal or the avarice of the archbishop might have been satiated with the richest spoils which were the rewards of his victory." The library was, at all events, dispersed, if not destroyed: it ceased to exist as a public institution.

THE PITCH LAKE OF TRINIDAD.

THE PITCH LAKE OF TRINIDAD.

THE Pitch Lake of Trinidad is one of those extraordinary natural wonders of which much has been reported on hearsay, but little from personal observation. Writers have been content to borrow from former accounts, when describing the place, so that errors have been perpetuated which ought to have been corrected. The island of Trinidad, in which the Pitch Lake is situated, lies out of the ordinary routes of travellers, and the lake is not accessible without the expenditure of some trouble, even after the traveller has been landed at Port of Spain. These reasons will account for a good deal of the obscurity with which the accounts of this singular phenomenon are surrounded.

A morning's sail down the south-western coast of the island will bring the traveller from Port of Spain to Cape La Brea, in the neighbourhood of Naparima. For several miles before reaching the cape there will be perceived a strong pitchy smell, and it will be found on landing that the beach and shore are perfectly black, being either composed of, or overlaid with, the pitch which has at some time or other found its way down from the lake. There is abundant vegetation springing up in dark earth more or less impregnated with pitch, and the bright fresh green of the shrubs and trees serves the better to set off the vulcan-like colour of the ground. A walk inland for a mile over a black road on which the finely-divided particles of pitch form a choking and a blinding dust which flies with every puff of wind hither and thither, brings the traveller to the lake. The road has been ascending from the shore, and the lake is at a level of eighty feet above the level of the sea. At the lake, "as on either side of the road for the whole way, the number and luxuriant growth of the trees are very remarkable. Nearly all the tropical plants are represented, and, as if not to allow the animal kingdom to be unfavourably contrasted with the vegetable, numbers of the most beautiful butterflies it is possible to see, and of the most gorgeously-dressed humming-birds,

flutter and flit about in the sunlight, or fly in and out among the branches of the trees."

The lake itself is contained in a basin about a mile and a half in circumference. In the months of July, August, and September the contents are in a simmering condition; fountains of pitch, boiling water, and argillaceous matter are thrown up here and there to a height of thirty feet, and objects, however light, allowed to fall into the lake, sink down and are irrecoverably lost. During the rest of the year, however, the pitch at the borders, and for a considerable extent away from them, is comparatively hard; soft and dangerous parts are indicated by the bubbling asphalte and by the increasing insecurity of the footing. Even at times when it is practicable to walk on the lake, it is not safe to stand still; the footsteps leave their imprint on the soft substance of the surface, and it is necessary to keep "moving on" in order to avoid sinking as into a quick-sand. At these times the pitch lies in large hummocks, between which run small rivulets of fresh water, clear as crystal, and with a sulphureo-pitchy taste, which act as a system of veins and arteries to the Tartarean lake. Small islets, covered with the greenest shrubs and plants, are dotted about the surface of the lake, which engulfs them immediately the liquefying season comes, but reproduces them on the arrival of the next cool season. It is supposed that the lake has subterranean communication with the sea, poles marked with special characters having been found on the coast, which had erewhile been thrust into the asphalte of the lake. That a communication does exist is more than likely; for at some distance from Cape La Brea there are submarine pitch volcanoes which throw up quantities of pitch and Pitch Lake products into the sea; and it is at all events reasonable to suppose that these and the lake are connected. Humboldt, De Verteuil, and other authorities affirm that there is a correspondence between all of these and similar phenomena on the South American continent, with which the island of Trinidad was unquestionably once joined.

TRANSFUSION OF THE BLOOD.

Among the wonders of surgery, nothing is more remarkable than the operation of transfusion, which has occasionally been performed with success in very extreme cases. It consists of conveying a portion of the blood from the veins of a healthy and vigorous person into those of one sinking, and apparently at the point of death. A case of this kind has lately occurred in the Hospital della Concezione at Palermo. A youth of seventeen, named Giuseppe Gnazzo, was received into that establishment in September, 1868, with a bad humour in his leg, which eventually rendered amputation necessary. The patient was very much emaciated, and labouring under fever, and after the operation he became more reduced than ever, the pulse being imperceptible, the eyes dull, the body cold, and it was clearly apparent that he was sinking fast. In this emergency, his attendant, Dr. Enrico Albanese, had recourse to transfusion of the blood as the only remedy that had not yet been tried. Two assistants of the hospital offered to have their veins opened for the purpose, and thus a quantity of blood on two different occasions was introduced into the patient's system. He began at once to revive, and after the first operation he recovered the faculty of speech, stating that before he could neither see nor hear, but felt as if he were flying in the air.

A similar, and even more interesting case, occurred a few years back in Staffordshire, the operation then being performed on a lady residing in Cannock. The patient seemed to be expiring from loss of blood, when her husband, at the suggestion of the surgeon, Mr. J. Wheatcroft, consented to the experiment of transfusion, and two pounds of blood were conveyed from his veins into those of his wife. In a few minutes after the operation was performed the current of blood began to flow, the "ebbing of life" was checked, and the circulation being re-established, deliverance from death, which had seemed so near, was secured.

The suggestion has been thrown out that in the last stage of low typhus, and the collapse attendant on Asiatic cholera, the same remedy might possibly prove of service. But we have not yet heard of the experiment being tried in such a case.

Wonderful Disappearances.

ELIZABETH CANNING.

The *Daily Advertiser* of the 6th of January, 1753, contained the following advertisement of a remarkable disappearance, the subject of which afterwards gave rise to a singular trial, which divided opinion in England, and was debated with all the excitement of a great political question:—

Whereas, Elizabeth Canning went from her friends between Houndsditch and Bishopsgate, on Monday last, the 1st instant, between 9 and 10 o'clock: whoever can give any account where she is, shall have two guineas reward, to be paid by Mrs. Canning, a Sawyer, in Aldermanbury Postern; which will be a great satisfaction to her mother.

A description of her appearance and dress is added, and the following note is appended:—

It is supposed she was forcibly taken away by some evil-disposed person, as she was heard to shriek out in a hackney coach, in Bishopsgate Street. If the coachman remembers anything of the affair, by giving an account as above, he shall be handsomely rewarded for his trouble

Nothing was heard of Elizabeth Canning for more than three weeks. At last, on the 29th, she returned to her mother's house, in an exhausted

and miserable condition. She related that two men had seized her near Bethlehem Gate, in Moorfields, and when she resisted their attempts to drag her along, had tied her hands behind her, and with the greatest brutality compelled her to accompany them, dragging her through the mire, and otherwise ill-treating her. They reached a lonely house by the roadside, about three hours before daylight, when she was handed over to an old woman, who forced her up an old flight of stairs into a back room, like a hayloft. Here she was kept a close prisoner, and fed on bread and water only, until the afternoon of the day on which she returned home. She then escaped by breaking through the window of the room and jumping into a narrow lane, from whence she gained the main road to London, and, without having stopped anywhere on the way, reached her home in six hours.

Other statements made by Elizabeth Canning led to the suspicion that the house in which she had been detained was a place known as "Mother Wells's," at Enfield Wash. The girl was taken to make a deposition before the sitting alderman, and eventually a number of persons were arrested - viz., Mother Wells, the owner of the house; an old gipsy woman named Mary Squires; this old woman's son and daughter, and another wandering gipsy named Judith Natus. Elizabeth Canning swore to Mary Squires as being the woman who had received her into custody at the house and cut off her stays. As the investigation went on, however, the most extraordinary discrepancies were discovered in her story; among the rest, her description of the room was not in agreement with the ascertained facts. Nevertheless, both Mary Squires and Wells were found guilty of the alleged felony, and, according to the law of those times, the poor old gipsy was sentenced to death.

It would be hard to describe the excitement which arose out of this case, unless we filled several columns with details of the conflicting evidence and of the reasons which induced certain public characters to espouse the different sides of the question. The notorious "Orator" Henley declaimed to excited crowds in favour of Elizabeth Canning; and Justice Fielding pronounced on the same side with the deliberation which suited better to his dignity. On the other side was a popular writer, Dr. John Hill, who reasoned with much acumen in favour of the condemned gipsy; and with him was the equally acute Lord Mayor of London, Sir Crispe Gascoyne. These uniting their efforts, the sentence against Mary Squires was suspended, and in the April sessions of 1754 Elizabeth Canning was put on her trial at the Old Bailey for perjury. During the eight days that this trial lasted, the public were kept in a state of intense excitement. At last an extraordinary verdict was returned—"Guilty of perjury, but not wilful or corrupt." Such a verdict could not, of course, be received by the court; and at last it took the form of "Guilty, with a recommendation to mercy." Canning was then sentenced to seven years' transportation.

The cause or motive of this girl's disappearance has never been explained; but it is not unreasonable to surmise that she had some good reason to secrete herself for awhile, and that she was led on, step by step, to invent the story which excited so much attention.

Ancient Manuscripts.

VALUE OF MANUSCRIPTS IN ANCIENT TIMES.—Before the invention of printing, literature only existed in the form of manuscripts, which were exceedingly rare and costly. "There have been ages," says the elder Disraeli, "when, for the possession of a manuscript, some would transfer an estate, or leave in pawn for its loan hundreds of golden crowns, and when even the sale or loan of a manuscript was considered of such importance as to have been solemnly registered by public acts. Absolute as was Louis XI. he could not borrow the MS. of Rasis, an Arabian writer, from the library of the Faculty of Paris, for copying, without pledging a hundred golden crowns; and the president of his treasury, charged with this commission, sold part of his plate to make the deposit. For the loan of a volume of Avicenna a baron offered a pledge of ten marks of silver, which was refused, because it was not considered equal to the risk incurred of losing the volume. These events occurred in 1471. One cannot but smile at an anterior period, when a Countess of Anjou bought a favourite book of Homilies for 200 sheep, some skins of martens, and bushels of wheat and rye. In these times manuscripts were important articles of commerce. They were excessively scarce, and preserved with the utmost care. Usurers themselves considered them as precious objects for pawn. A student of Pavia, who was reduced by his debaucheries, raised a new fortune by leaving in pawn a manuscript of a body of law; and a grammarian, who was ruined by a fire, rebuilt his house with two small volumes of Cicero." What a contrast do such facts as these present to the general diffusion of the most precious treasures of learning by the art of printing, as developed in recent times!

AN EARLY MANUSCRIPT OF THE BIBLE.—The Duke of Sussex, uncle of Her present Majesty, possessed a very fine manuscript of the thirteenth century, upon vellum, in two volumes, entitled, "Biblia Sacra Hebraica." At the end of the second volume was the following curious inscription in Hebrew:—"I, Meyer, the son of Rabbi Jacob the Scribe, have finished this book for Rabbi Abraham, the year 5052 (A.D. 1292), and he has bequeathed it to

his children, and his children's children, for ever. Amen, Amen, Amen. Be strong and strengthened. May the book not be damaged neither this day nor for ever, until the ass ascends the ladder." After this was drawn the figure of an ass ascending a ladder.

WONDERS OF ENGINEERING.

THE MONT CENIS TUNNEL.

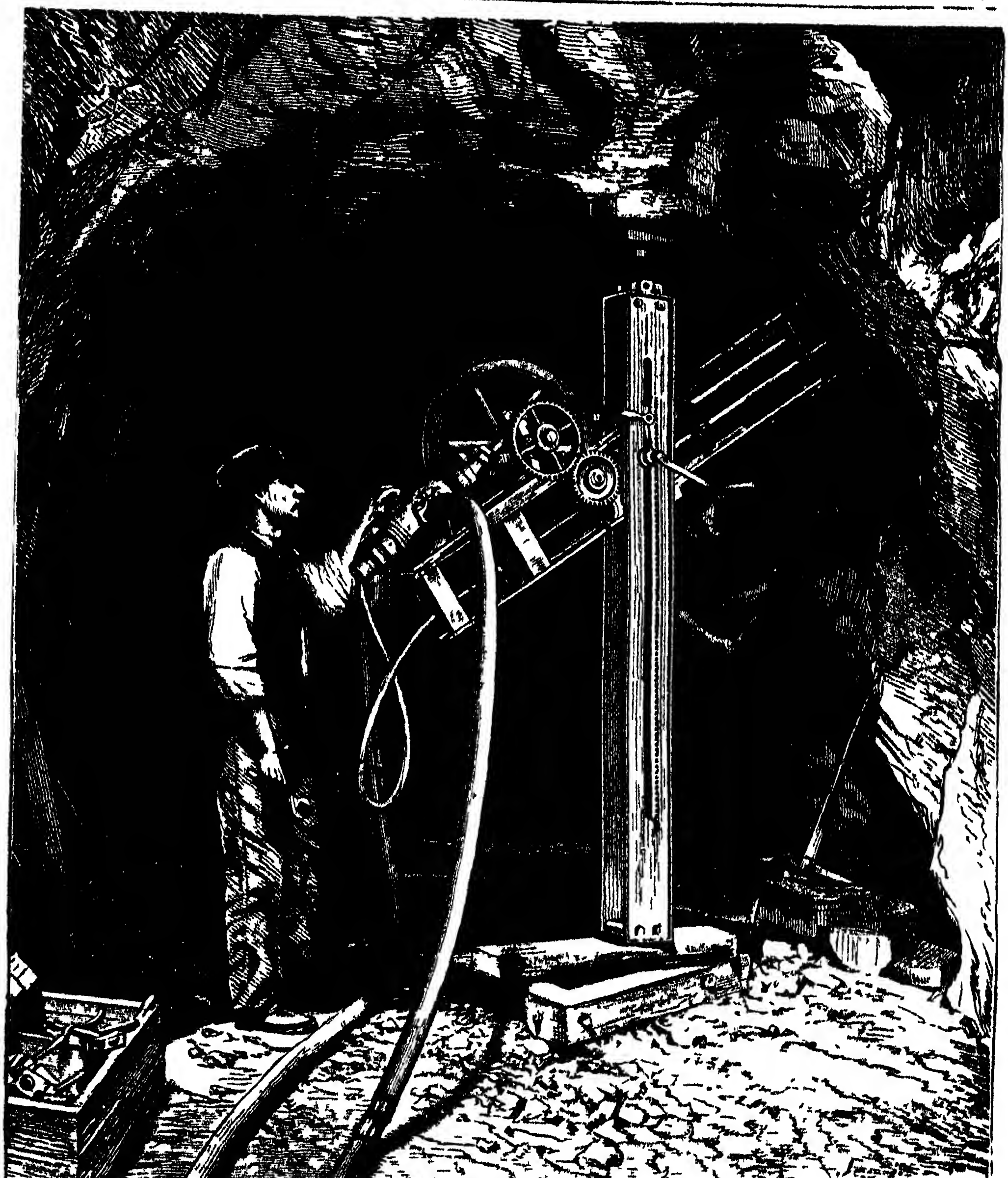
Of all the projects with which engineers of the present day surprise us, the most wonderful as yet actually in process of execution is undoubtedly the tunnel through the heart of Mont Cenis, the Alpine barrier between France and Italy. Every-one knows the story of the passage of the Alps by Hannibal in the old Roman times, and again by Napoleon in our own, both which events are regarded as marvels of daring and persistent endurance. In more recent times the passage over Mont Cenis has become the regular highway from France into Italy whenever, from the state of the weather, it was practicable. But the travelling was often interrupted by snow, and at most periods of the year was full of discomfort, if not of danger. Modern engineering proposed to put an end to all this, by going through the mountain instead of over it. To pierce through the very heart of Mont Cenis, a distance of more than seven and a half English miles, under circumstances which might well have been supposed to present insuperable engineering difficulties, is an achievement before which those of Hannibal and Napoleon sink into insignificance.

First, the perforating machinery had to be invented, and it was required to be powerful enough to make its way through rocks harder to work than even granite. The mountain mass consists, for the most part, of what geologists call a "crystallised calcareous schist," interrupted occasionally by large masses of pure quartz. A thousand years might have been spent in vain attempts to bore and blast this rock with the ordinary means. But the difficulty of the work only seemed to stimulate the ingenuity of the engineers, who vied with each other in producing the most elaborate machines for this purpose. Of these several were tried and put into actual use. The cut on the opposite page gives a representation of one of the most remarkable of them. It is the invention of a French engineer, M. Leschot. The remarkable feature about it consists in substituting for the ordinary iron bars, used to bore hard rocks, rotatory tools acting like an angular conical head, in which the steel teeth are replaced by diamonds.

The apparatus consists principally of an iron tube, at the extremity of which is a steel ring, in which black diamonds are set, projecting from the surface, some within, some without, and others a little in advance of the front edge. A rotary motion is given to this tube, with a greater or lesser pressure against the rock, which is broken up and bored wherever the diamonds touch it; the motive power employed is water, which has been found more convenient for the working of this machine than steam or compressed air. To further facilitate the working of the machine a stream of water is introduced either by means of an india-rubber pipe or even the iron tube containing the perforator, which washes away the fragments of rock which would otherwise soon choke the machine and stop its working. With this apparatus a hole of 2-10ths of an inch in diameter, and nearly 3¾ inches in depth can be made in a hard rock in the space of an hour.

But of course this, though wonderful enough in itself, only implied a very slow rate of progress. In any case, it was certain that many years would be occupied in boring a tunnel through the Alps, and the lapse of time would alone have made the work impracticable, since few people would be so mad as to supply large sums of money for a project which they might never see realised. It was resolved, therefore, to commence the tunnel from both sides of the Alps at once, and this rendered it necessary to contrive means for laying out the line accurately, so that the two bores might meet. Plans and levels to determine the sections, and to fix the axis of the tunnel from various points on the mountain, had to be taken under enormous difficulties of all kinds. At length this too was done so satisfactorily that, on making a final summary of the results, the deviation was found to be less than a foot for the whole distance.

We say nothing here of the extraordinary labour and various strange contrivances involved in the preparatory works, and how the difficulty of supplying air to the workmen was overcome; these are points which will be easily imagined by the reader. The work of tunnelling was not actually commenced till November, 1860, three years after the project had been sanctioned by the Sardinian government. The time allowed for the completion of the tunnel was twenty-five years, but such progress has been made, that it is reported it will be ready for traffic within three or four years from the present time. Out of a total length of 12,220 metres, equal to 7½ miles, the latest report shows that 8,958 metres, or about two-thirds of the distance, have been completed, leaving but 3,261 metres, say two miles in round numbers, to be accomplished. The rate of progress from either end is about two metres a day. The tunnel will be lined in its entire length with stone, which is quarried in the immediate vicinity of the two entrances, and the placing of which is continued by the masons a few hundred yards in the rear of the men engaged in perforating the rock. The tunnel is not driven at one uniform level. The



DIAMOND DRILLING MACHINE USED IN BORING MONT CENIS.

entrance on the French side, near the village of Fourneau, is 3,946 feet above the sea; on the Italian side, at Bardoneche, it is 4,380 feet above the sea-line. This difference of level, 434 feet, causes a gradient, or gradual ascent from the French side, for a distance of four miles, with an average gradient of 1 in 45½. the Italian gradient is 1 in 2,000. Trains passing from France to Italy will take from thirty-eight to forty minutes running through, while those from Italy into France will accomplish the distance in about thirty minutes It is confidently expected that the difference in level of the two ends of the line will accomplish, by natural means, the perfect ventilation of the tunnel, which otherwise would have been a work of perpetual expense, if not of considerable engineering difficulty. The expense of the tunnel is to be borne in equal proportions by Italy and France.

A WONDERFUL DELUSION.

EVERY lunatic asylum in the kingdom contains several patients suffering from religious mania, and there are, alas! numbers unconfined who are labouring under similar delusions; but this latter class is, happily, not so numerous as it was in former days. Old newspapers, pamphlets, and magazines contain copious accounts of various religious pretenders, and the life of each one affords matter of interest enough to warrant the telling; but it is proposed to speak of only one in this present article, more especially as it is certain that there are yet to be found people who believe in the Divine encouragement of her life and mission. Joanna Southcott was born in Devonshire about the year 1750, of very humble parentage. She was for many years a domestic servant in Exeter, and when she was between thirty and forty years of age, she joined the Methodists in that place, then presided over by a man called Sanderson, who pretended to the gift of prophecy. Joanna seems to have caught the infection, and started prophetess on her own account, expressing her foreknowledge either in a loose, doggrel, Seven Dials sort of rhyme, or, when she wrote in prose, she copied the manner, without the mind, of Holy Scripture.

She declared that she was the woman spoken of in the Revelation, in the 1st and following verses of the 12th chapter.

In consequence of this avowal she had numerous followers, to whom she sold seals, said to secure the salvation of the purchasers. Her followers included rich and poor, learned and ignorant, refined and rough folk of both sexes, one of whom, perhaps the most notable, was William Sharp the engraver. He had been the victim of many impostors, and was cured at last of his passion for religious pretenders by Joanna, who swindled him out of his hard-gained money under the pretence of purchasing for him an estate in the New Jerusalem. But the most glaring deception connected with this poor demented housemaid was, that she declared that upon the 19th of October in the year 1814, and at twelve at noon precisely, the Prince of Peace, the Shiloh, would be born of her. She had at that time nearly 100,000 followers, who spent much money in preparing a suitable outfit in clothes and furniture worthy of him who was expected. The cradle, which was made by a London upholsterer, and cost 100 guineas, is, with a silver ladle also prepared for the occasion, preserved in the museum at Peel Park, Salford, Manchester.

At the appointed time, the street in which she lived was crowded with anxious spectators, who dispersed when it was given out that the blessed Joanna had fallen into a trance.

On the 27th of December in the same year she ceased to exist the immediate cause of death being dropsy. On her death-bed, Joanna said, "If I have been misled, it has been by some spirit, good or evil." At least, it was fortunate for her that she lived in the days of comparative medical ignorance, and when many like her were permitted to go at large. During the course of her life she had given to the world several volumes of so-called prophecies, one of them called "The Book of Wonders," which were religiously preserved after her death by her followers, who still continued to believe implicitly in her mission.

According to the census of 1851, there were four congregations in various parts of the kingdom, professing to wait for the reappearance of Joanna with the promised Shiloh, they believing that she was carried to heaven in that trance in which she actually died. These people call themselves Christian Israelites, the waiters for the Shiloh. They affect a singularity in dress, wearing a modification of the Quaker garb. All these people still lay claim to the gift of prophecy, and they have from time to time pretended to have been endowed with miraculous powers; but in every case in which these powers have been called forth, have they failed most completely.

In Ashton-under-Lyne, where there is one branch of this remarkable sect still existing, one of these people obtained so much influence over the mind of a weak but wealthy inhabitant of that place, as to make him believe that he had power to walk upon the water of the canal, which was close upon his house. In the presence of a great crowd he stepped out from his house upon the water, and—went to the bottom. It is, perhaps, only superfluous to say that the "Prophets" attributed his failure to want of faith.

A few years back, one of these congregations assembled in Walworth, in the southern part of London; they met in a cooper's shed, under the shadow of St. Peter's Church.

On a desk were laid copies of some pamphlets written by Joanna, and after a little time the Shilohites—as they called themselves—made their appearance in front of the curtain, headed by a wild-looking woman, with her hair streaming, and a fillet of tinsel round her forehead. The men who accompanied her wore long beards, and white vestments, crossed by belts with texts of Scripture inscribed thereon.

In the days when this took place, the beard movement had not begun, so that their appearance would have been venerable, for they were mostly old men, had it not been for a certain wild, restless expression common to all. The proceedings commenced by the recitation and singing of some doggrel verses, beginning "See the conquering Shiloh comes," a parody of that well-known chorus in Handel's Judas Maccabeus, accompanied by a large drum—hitherto kept concealed—and

an accordion. Some extracts were then read from the "Book of Wonders," written by Joanna, by the wild-looking woman before mentioned, occasionally interrupted with remarks by the boys forming the congregation, by whose riotous proceedings the service was brought to a premature conclusion, and the building was closed.

THE GOLDEN HOUSE OF NERO.

On that part of the ruins of Imperial Rome lying between the Palatine and the Esquiline Hills—a space which was more than a mile in breadth—Nero erected his celebrated "Golden House," as he called the new palace in which he fixed his abode. The vastness of extent and the varied magnificence of this imperial residence and its ornamental grounds, almost surpass belief; and if the details that have come down to us respecting it were not too well authenticated to admit of doubt, they might be regarded as fabulous. Within its enclosure were comprised spacious fields, groves, orchards, and vineyards; artificial lakes, hills, and dense woods after the manner of a solitude or wilderness. The palace itself consisted of magnificent buildings raised on the shores of the lake. The various wings were united by galleries each a mile in length. The House or immediate dwelling of the emperor was decorated in a style of excessive gorgeousness. It was roofed entirely with *golden tiles*, and with the same precious metal also the marble sheathing of the walls was profusely decked, being at the same time embellished with ornaments of mother-of-pearl—in those times valued even more highly than gold—and with a profusion of precious stones. The ceilings and woodwork were inlaid with ivory and gold, and the roof of the grand banqueting-hall was constructed to resemble the firmament. It was contrived to have a rotatory motion, so as to imitate the motion of the heavenly bodies. The vaulted ceilings of ivory opened and let fall on the guests a profusion of flowers, and golden pipes sprayed over them the most delicate perfumes.

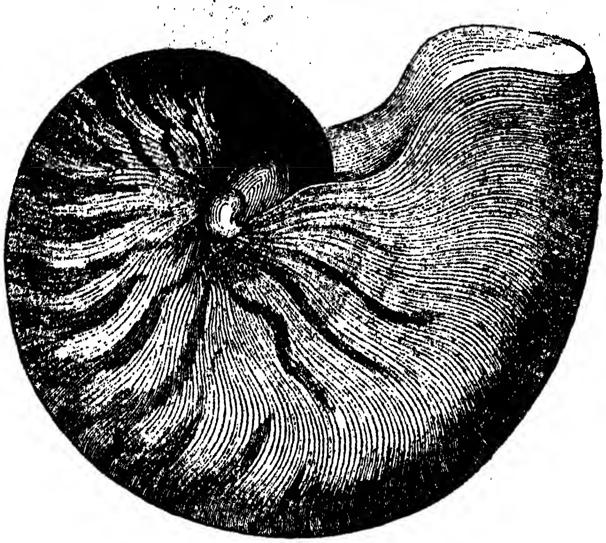
The vastness of the plan prevented the Golden House of Nero being finished during his lifetime. Vespasian drained the principal lake of this fairy region, on which he built the Colosseum, and pulled down all that Nero had erected beyond the Palatine, reducing the Imperial palace to the hill that once contained Rome. Domitian built up what his predecessor had pulled down, and added to the palace the Adones, or halls and gardens of Adonis, the splendid wonder of that age of magnificence. Septimius Severus made several additions to the south of the Palatine, especially the Septizonium, the site of which has been much disputed; while in later days Pope Sixtus V. carried off to St. Peter's the three orders of columns of which it was composed. Among the modern discoveries of the palace, were a room full of Roman coins, and a hall hung with cloth of gold, and on another part of the Palatine a spacious hall covered with paintings. The fall of the palace of the Cæsars was a true picture of plunder. In the fifth century the Goths pillaged it of all its gold, silver, ivory, &c.; its bronze fell to Genseric, and the Vandal is supposed to have freighted a ship with statues from the Imperial palace. In the long feudal wars of the Roman nobles, it was attacked and fortified, taken and retaken; but the Farnese popes and princes gave the finishing stroke to its desolation, to enable them to erect their palaces and villas with its materials.

THE NAUTILUS AND PORTUGUESE MAN-OF-WAR.

There are two wonders of the deep which are often confounded with each other, the nautilus and the little creature which is known to sailors as the Portuguese man-of-war. Both are sea-farers, but the nautilus is to its rival as the most fanciful, delicate yacht is to the water-bruising frigate. The nautilus is a fair-weather sailor, while the other, though unable to face storms, is yet a hardy, open-sea navigator, spreading its canvas when winds are fresh, and anxious to make a good offing when the nautilus is only too solicitous to foregather, even with a lee shore, so it may be unexposed "while the stormy winds do blow."

Judged according to their respective ranks in the scale of animal life, the nautilus is of far greater consequence than the *Physalia Atlantica*, for such is the scientific name for the Portuguese man-of-war. The nautilus is a member of a rather highly organised family, while the *physalia* is only one of "the upper ten thousand" in a community where the vital system is so simple and rudimentary, as to be hardly admitted into the animal kingdom. Both are wonderful in construction and habit. Let us see what the *physalia* is like. Floating on the surface of the water is an elegant quadrant of membrane distended like a sail, and almost transparent. It is generally of a whitish-blue colour, fringed at the edges with a beautiful pink or purple. The membrane which has the appearance of a shell, and is commonly taken for one, is flattened at the sides, which at the level of the water are usually from two to four inches apart. The sail thus made is used by the little creature as his only means of progression, and in the sides of the cavernous sail are ribs or wrinkles, which suggest an idea that the proprietor has the power of reefing his canvas at will, by a sort of self-reefing apparatus put in action from the deck, and preventing the necessity for "hands aloft," or for

driving under bare poles. As quaint Richard Ligon, writing in 1673, says of him, he "can when he pleases enjoy himself with his neighbour fishes under water, and when he puts on a resolution to try his fortune in another element, then he riseth to the top of the sea, let the billows go never so high, and then without the help of a sailor raises up his mainmast, spreads his sails which he makes of his own sinews, fits his rudder and ballast, and begins his voyage; but to what coast he is bound or what traffic he intends, himself and He that made him only can tell." The creature will out-sail any ship, and as the author just quoted says, "can go nearer the wind by a point than the most yare friggot that ever was built." It is not according to the present writer's experience, however, to confirm the statement that the *physalia* can continue his voyage, "let the billows go never so high." On the contrary, though in stiff breezes and with a roughish sea the little creature may be seen hundreds of miles from any land, speeding swiftly along, up one wave and down another, in really foul weather—or rather on the approach of it—he strikes sail, folds himself within himself, and subsides into the bosom of the ocean till the surface be once more calm, and the wind tyranny be overpast.

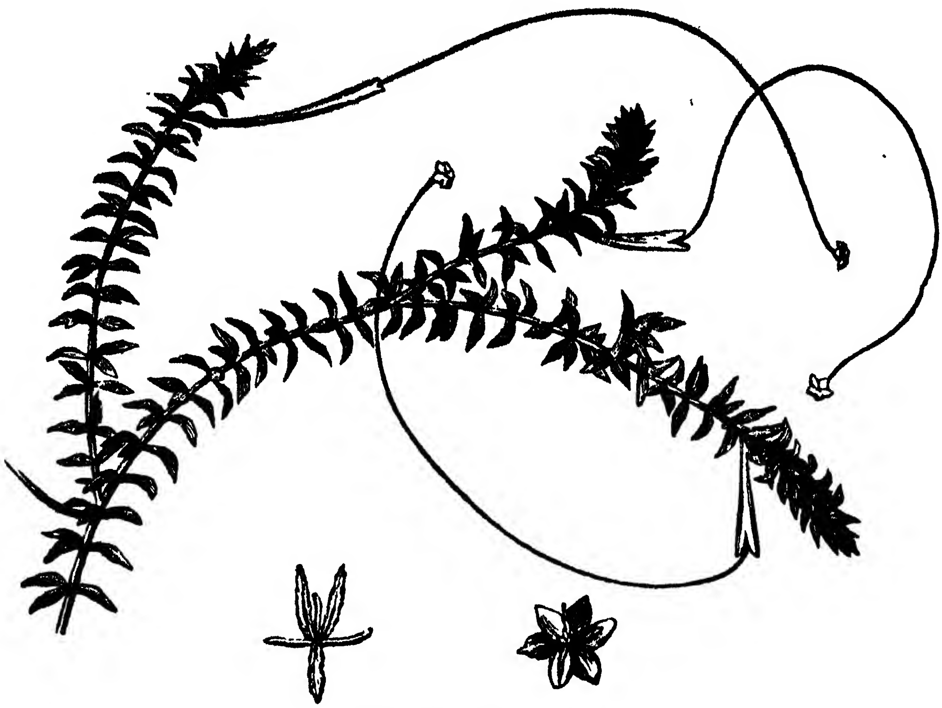


SHELL OF THE PEARLY NAUTILUS.

The *nautilus* is a mariner of quite another stamp, with a pedigree far nobler in point of antiquity than the other, for its form and substance are enshrined in many of the fossil strata of the earth; and in its family history it has, as the Basque peasant retorted to the boastful Montmorency, left off dating. It is one of twenty-two recognised families, whereof some have their habitation in fresh water and others in salt, and this nautilus in particular is called *Nautilus umbilicatus*, because of the ligature which connects the different portions of its body when exposed over the sides of its shell, as its manner is when bound seaward. It has a uni-valve shell of a highly-organised description. Each shell is divided by partitions into a number of chambers which gradually increase in size towards the mouth of the shell where the nautilus animal actually lives. As the animal grows it increases the size of its shell by additions at the mouth, and at the same time cuts off a chamber in the interior of the shell. These chambers are so many air compartments which the nautilus can fill or empty at will, and by means of which he can adapt himself to the specific gravity of the medium in which he happens to find himself. Those who have most closely watched his habits, assert that he is naturally disinclined to surface-navigation, that he only takes to it when absolutely compelled by disturbing causes underneath, and that his favourite occupation consists in creeping along the bottom of the sea with the mouth of his shell downwards, and in that position fishing for such food as may come to him. When at the surface, he is seen to float with his shell the reverse way, and with his body hanging over the edges, but secured by the ligature from which he derives his class name.

PORTUGUESE MAN-OF-WAR.

The nautilus is rarely seen out of the Indian seas; but the Portuguese man-of-war is to be noticed over a wide range of the Atlantic—in the northern hemisphere from the Azores to the equator. Our illustrations will give the reader an idea of the appearance of these two wonderful navigators.



ANACHARIS ALSINASTRUM.

A WONDERFUL WEED.

ILL weeds proverbially grow apace, and perhaps nothing affords a more striking illustration of this familiar saying than the water-weed known as the *Anacharis alsinastrum*, called also by some botanists the *Elodea Canadensis*, and known more commonly as the American water-weed, or "water thyme." It is found in ponds, rivers, or canals, and when once it makes its appearance it spreads in such an extraordinary manner as in a short time to entirely destroy the beauty of ornamental water, and even to obstruct the navigation in canals and streams. It floats wholly under water, but at the time of flowering makes its appearance on the surface, its roots being widely spread in the mud at the bottom. It has the peculiar faculty of being capable of propagation from the smallest fragment of its stalk, and hence it is a matter of great difficulty to get rid of it. Another peculiarity of the weed is that it sometimes suddenly springs up in places where it had never been observed before, but this is doubtless owing to some small portion having been brought to such localities by the wind, or occasionally, it may be, even in the bodies of water-fowl.

At the present time it is growing to a serious extent in some of our principal rivers, such as the Trent and the Shannon. In these it impedes navigation materially, and fishermen complain, also, that it kills or drives the fish from the water.

The *anacharis* (from *ana*, without, and *charis*, beauty,) is believed to be a native of America, where it is certainly found in great abundance, but nothing is positively known as to the time and manner of its introduction into these islands, beyond that it has only been observed in recent years. One story is that a portion of the weed was brought to England from America with a number of other botanical specimens, and that a gentleman who was taking these specimens with him in a cab recognised it, and, instead of keeping it for effectual destruction, thoughtlessly threw it out of the window, whence it fell on to a spot suitable to its growth. There is not, however, sufficient evidence to establish the truth of this anecdote, and its probability is contradicted by the accounts given of the weed by some of our eminent botanists, who assert that it made its appearance in several remote parts of Britain simultaneously, and that its existence was observed farther back than is generally supposed. Among those who have written on the subject, are the authors of "Contributions towards a Cybele Hibernica," in which work the plant is thus described :—

"A native of America recently introduced, but now not unfrequent in canals, streams, and ponds

in many parts of Ireland. Abundant in the canals near Dublin and Belfast, whence it has extended to Lough Neagh and the River Shannon, and is still spreading, having become in some places a very troublesome weed. Professor Murphy describes it as being now a great nuisance in the River Lee, below Cork, having been introduced in 1851. Mr. Carroll has seen it growing plentifully in the river at Carlow. Dr. Dickie has recorded its having been observed in a pond at Waringstown, Down, about the year 1836; and in his 'Flora of Ulster' it is stated to have been known near Lisburn for more than twenty years previous to 1864."

The very measures taken to check the growth of the anacharis often favour its propagation, small pieces of the plant becoming dispersed, and taking root immediately for themselves, owing to the vitality before mentioned. In streams of any size it is scarcely possible to deal with the weed effectually, and every year its spread is accelerated by portions being brought down by the currents. In ponds, however, and small ornamental water, it has fortunately been found that it may be kept entirely under by the introduction of swans or Canadian geese, which devour it eagerly.

THE ORRERY.

It was believed by Desaguliers that George Graham, about the year 1700, first invented a movement for exhibiting the motion of the earth about the sun, at the same time that the moon revolved round the earth. This machine being in the hands of the instrument-maker, to be sent with some other instruments to Prince Eugene, he copied it, and made the first for the Earl of Orrery, and then several others with additions of his own. Sir Richard Steele—who knew nothing of Graham's machine—in one of his lucubrations, thinking to do justice to the first encourager, as well as to the first inventor of such a curious instrument, called it after the earl, an *Orrery*, and gave Mr. J. Rowley the praise due to Mr. Graham. We find, however, earlier mention of an orrery than the above, in the journal of the Dean of Ross, under date 1689.

"December 14.—In the evening Mr. Milburn came and sat with me, and showed me an account of an automaton projected and made by Mr. Watson of Coventry, whereby all the stars' motions, and planets, were exactly represented in clockwork, and all the problems and observations in astronomy thereby fully answered."

Orreries have been constructed by several ingenious persons. Mr. John Fulton, a native of Fenwick, was a self-taught artist, and constructed a beautiful orrery; hence the maker was called "Fulton of the Orrery." He was a working shoemaker in his native village, of scanty means and education, yet, by dint of application during his leisure hours, he executed the above instrument with the greatest care and finish. He was afterwards employed by Mr. Bate, the well-known mathematical instrument maker in the Poultry, where he made theodolites for the Pasha of Egypt, and balances for the Royal Mint. Fulton also applied himself to the study of languages, but his health failed him through excessive application, and he died at a comparatively early age.

AN EXTRAORDINARY SLEEPER.

The following account of a labouring man, named Samuel Clinton, of Timbury, near Bath, is taken, so far as the substantial facts are concerned, from the *Philosophical Transactions*. On the 13th of May, 1694, Clinton, who was then twenty-five years of age, fell into a profound sleep, in which he continued for a month. Every effort was made to rouse him, but in vain. At the end of that time he awoke of himself, and went about his business as usual. Nothing more extraordinary occurred until the 9th of April, 1696, when he again fell into a profound sleep. Mr. Gibbs, an apothecary of Bath, was sent for after a few days, and bled, blistered, cupped, and scarified the young man, all to no purpose. Victuals were kept before him, of which he occasionally ate without waking. Sometimes the act of eating was not fully accomplished, and he would be found with his mouth full of meat. In this manner he continued for seventeen weeks, till the 7th of August. He then awoke naturally, put on his clothes, and went into the fields to his work. He was surprised to find it was harvest time, the period that had elapsed since he was at work sowing oats and barley having been a blank. From this time, again, he remained well until the 17th of August, 1697, when he complained of a shivering and a coldness in his back, vomited once or twice, and once more fell asleep. Dr. Oliver, whose account of the matter appeared in the *Philosophical Transactions*, then went to see him, and found his pulse regular, and his body agreeably warm. He tested the sleeper in the most severe manner, and tried by every artifice he could devise to surprise him into wakefulness, and was at last compelled to admit that the sleep was real. About ten days after, an apothecary (Mr. Gibbs, we presume) took fourteen ounces of blood from his arm, tied it up again, and left him as he found him, without the least movement having been made by the sleeper. About the end of September, Dr. Oliver saw him again, and a gentleman ran a large pin into his arm to the very bone, but Clinton gave no sign of being sensible of what was done to him. Once, on the 19th of November, he woke up and spoke to his mother, but almost instantly went to sleep again, and continued so till the end of January or beginning of February. He then awoke

perfectly well, and, as on former occasions, had no recollection of anything that had occurred. He resumed his business, and nothing more is on record concerning him.

LAND AND MOUNTAIN SLIPS.

On the morning of the 2nd of September, 1806, the inhabitants of the village of Goldau, situated at the foot of the mountain known as the Rossberg, in Switzerland, were surprised to see large fissures appearing here and there in the sides and at the base of the mountain, and to hear low, hollow sounds occasionally emitted from its depths. Unacquainted with natural phenomena, and ignorant of the meaning of these strange portents, they do not seem to have concerned themselves much about them, but pursued their ordinary avocations as if nothing had happened. So things went on throughout the day, the sounds still continuing at intervals, and the fissures becoming wider, but yet not so much so as to create uneasiness or alarm. Nightfall came on, and most of the people had retired to their homes, when the hour of the threatened visitation arrived. In a few minutes, and without further warning, the upper portion of the vast mountain shook, gave way, and descended upon the doomed village of Goldau, with three others that lay scattered around its base, burying them and all that they contained. More than 450 people were killed, with the herds of cattle which it was their chief business to tend; but, strange to say, a few persons were extricated some days afterwards while still alive.

This sad calamity would, if scientific men had been upon the spot, have been perfectly foreseen from the morning's indications. "Land-slips," as they are called, or mountain slips, are sufficiently familiar to all who are versed in physical science, and they have played an important part in the formation of the present surface of all countries of the earth. Our own land presents abundant examples. Not to multiply instances, we may mention that of the celebrated Undercliff, the most beautiful part of the Isle of Wight, which was formed by an immense slip of the land from the high cliffs above, the lower strata on which they rest having been undermined by the action of the sea.

In the case of Goldau and its unfortunate neighbours, the same agency—water—had operated in another but equally well-understood manner. To explain it we must refer to one of the most interesting branches of geological inquiry.

The action of the weather is continually producing a change on the surface of our globe. This change, as a rule, progresses slowly, although its results in the course of years are very clearly seen. Even hard granite rocks become completely pulverised in time by the influence of rain and wind, their surfaces being reduced to powder to the depth of many feet, and thus hollows are eventually scooped out as completely as by the blasting operations of the engineer. But the rain also operates in a manner other than this, which is known as "disintegration." It produces wonders by what is known as the "percolation of the soil." Here we have the explanation of the calamitous phenomenon of the Rossberg. The season of 1806 having been very rainy, great quantities of water had penetrated through the sides and at the foot of the mountain, and lodged in the softer strata at its base. The upper portion of the Rossberg is formed of a conglomerate of flint and rock, commonly known as pudding-stone, which rests upon a foundation of sandy soil. By the influence of the heavy rains, the sandy foundation of the mountain became completely saturated with water, and at last it was so far undermined that there was no longer the necessary support for its great weight, and the upper portion toppled over upon the plains beneath.

It is not often that geological changes of this kind occur on so large a scale, or are so terrible in their results, but to a less extent they are among the most frequent of natural phenomena. Any well-informed traveller who observes the features of a country through which he passes may notice that in innumerable instances the superficial formation is due to a slip of earth from hill or mountain, and we occasionally hear that in our own islands some striking instance has taken place. The outline of our sea-coast is always in process of change, from the combined action of the weather and the sea. One of the largest of our land-slips in recent times occurred in Dorsetshire about thirty years ago, when a mass of chalk about three-quarters of a mile long slipped from its bed of clay towards the ocean.

WONDERS OF HUMAN FOLLY.

THE TULIP MANIA.

We often hear of "fancy prices" being given for articles of rarity, such as new varieties of plants, or birds just introduced from foreign parts. Twenty guineas for a flower, and one hundred for a fowl, may seem wildly extravagant sums, but such have been occasionally paid by wealthy people determined to possess any novelty, whatever may be the cost. This rage for rarity attained extraordinary proportions in the "Tulip Mania," as it is commonly called, of the seventeenth century, when the desire for the possession of tulip bulbs—then but recently introduced into Europe—gave rise to a trade which ended in a vast and ruinous speculation.

Tulips appear to have been unknown in Western Europe until the middle of the sixteenth century, when their culture was introduced from the Levant.

They were grown at first only in the gardens of a few naturalists, but, becoming more widely known, they found their way to Holland. Here, the character of the soil and climate being highly favourable, their cultivation was attended to with great care, and the plants became more and more in request as they increased in variety and beauty. Dutch merchants made their purchase and sale a part of their regular trade, and supplied other nations of Europe with their importations.

Any tulip of a new and rare kind was sure to obtain purchasers at a considerable advance on the ordinary value; for among tulip-growers the strongest rivalry existed as to who should have the choicest selection. This rivalry formed the basis of the tulip mania, for people began to buy up bulbs of the rarer kinds, in order that tulip-fanciers might be forced to come to them and purchase them at a greatly enhanced price. Several individuals making a large profit in this way, others entered the field to join in the speculation. Thus the demand increased, and the price went higher and higher; the tulips being bought, not for their own intrinsic beauty, but with regard to what it was thought they might eventually bring in the market. The preposterous height to which this folly attained will best be understood by the following facts, which are given by Beckmann in his "History of Inventions:"—

"The trade was not carried on throughout all Europe, but in some of the chief cities of the Netherlands, and rose to the greatest height in the years 1634-37. Munting has given, from some of the books kept during that trade, a few of the prices then paid, of which I shall present the reader with the following. For a root of that species called the Viceroy, the after-mentioned articles were agreed to be delivered:—2 lasts of wheat, 4 of rye, 4 fat oxen, 3 fat swine, 12 fat sheep, 2 hogsheads of wine, 4 tuns of beer, 2 tuns of butter, 1,000 lb. of cheese, a complete bed, a suit of clothes, and a silver beaker; making a total value of 2,500 florins (about £250). The tulips were afterwards sold according to the weight of the roots. Four hundred perits (a small weight of less than a grain) of Admiral Leifken cost 4,400 florins; 446 ditto of Admiral Von der Eyk, 1,620 florins; 200 ditto Semper Augustus, 5,500 florins, &c. A root of the species Semper Augustus has been often sold for 2,000 florins; and it once happened that there were only two roots of it to be had, the one at Amsterdam and the other at Haarlem. For a root of this species one agreed to give 4,600 florins, together with a new carriage, two grey horses, and a complete set of harness. Another agreed to give for a root twelve acres of land. Those who had not ready money, promised their movable and immovable goods, houses and lands, cattle and clothes. One man was said to have gained by this trade more than 60,000 florins in the course of four months. It was followed not only by mercantile people, but also by the first noblemen, and by citizens of every possible station.

"At first every one won and no one lost. Some of the poorest people gained in a few months houses, coaches, and horses, and figured away among the wealthiest in the land. In every town some tavern was selected, which served as a 'change, where high and low traded in flowers, and confirmed their bargains with the most sumptuous entertainments. They formed laws for themselves, and had their notaries and clerks. A speculator often offered and paid large sums for a root which he never received and never wished to receive. Another sold roots which he never possessed or delivered. Oft did a nobleman purchase of a chimney-sweep tulips to the amount of 2,000 florins, and sell them at the same time to a farmer; and neither the nobleman, chimney-sweep, nor farmer had roots in his possession, nor wished to possess them. Before the tulip season was over, more roots were sold and purchased, bespoke and promised to be delivered, than in all probability were to be found in the gardens of Holland; and when Semper Augustus was not to be had, which happened twice, no species, perhaps, was oftener purchased and sold.

"To understand this gambling traffic (continues Beckmann), it may be necessary to make the following supposition. A nobleman bespoke of a merchant a tulip-root, to be delivered in six months at the price of 1,000 florins. During these six months the price of that species of tulip must have risen or fallen, or remained where it was. We shall suppose that at the expiration of that time the price was 1,500 florins; in that case the nobleman did not wish to have the tulip; and the merchant paid him 500 florins, which the latter lost and the former won. If the price was fallen when the six months were expired, so that a root could be purchased for 800 florins, the nobleman then paid to the merchant 200 florins, which he received as so much gain; but if the price continued the same, neither party gained or lost. In all these circumstances, however, no one ever thought of delivering the roots or of receiving them. . . . The whole of this trade was a game at hazard, as the Mississippi trade was afterwards, and as stock-jobbing is at present."

At length the trade, like many similar speculations, collapsed. Many persons who had suffered ruinous losses broke their contracts; faith in the ultimate realisation of the money which the tulips were supposed to represent then fell suddenly to the ground, and ruin was spread far and wide. The holders of roots, for which they had paid immense sums, found no one to take them off their hands, and discovered then that they had parted with money and lands for a thing which was of absolutely no value beyond the fictitious price which had been set upon it.

THE FISHING-FROG.

THE FISHING-FROG.

AMONGST the spiny-finned fishes, the two most remarkable are the sea-wolf and the *Lophius piscatorius*, or fishing-frog. The former, which is known in British seas, attains a length of six or seven feet, and in colder latitudes is even larger. It lives on crustaceans and molluscs, which it crushes with its formidable teeth and jaws—instruments of which it avails itself freely upon any attempt at capture. Fishermen, knowing its peculiarities, knock it on the head before it has a chance of doing mischief; and in Iceland the people eat its flesh, which is said to be excellent. The skin is used for making pouches and wallets, and the liver is used as a substitute for soap.

The fishing-frog, of which a drawing is annexed, is a very remarkable creature. It is known as the wide-gab, the angler, and the sea-devil (not to be confounded with the devil-fish), and is one of the ugliest of fishes. The head is very large, depressed, and rotundate, forming in many instances quite half the body. Its ample mouth is armed with numerous pointed teeth of a truly formidable character, which are the terror of all smaller fry. On the head are three movable filaments, of which the first one is forked, and has a silvery lustre. This is the creature's fishing-rod. He moves the flag-like top to and fro in the water, and the sheen of it attracts small fishes. The angler himself, being of a sluggish nature, lies close at the bottom of the water, where he disturbs the mud so as to hide his ugly presence; but as soon as an unfortunate fish is within reach, he rouses himself

from his lair, devours his prey, and resumes his fishing. Besides procuring food in this way—at one time it was said he used no other way—he hunts by netting, and for this purpose he uses the sac which is formed behind the gill-cover by the elongation of the gill membrane. At the fore part of the head, on each side of the first ray, lies the olfactory apparatus, in the form of a small, stalked cup. It is pretty certain that at times when food is scarce, and the fishing-frog is hungry—an almost perpetual condition of his—the *lophius* will abandon his sly mode of angling, and go off on an aggressive prowl, seeking what he may devour. He has been pulled up to the surface in company with a cod, from whose toothsome flesh he was only compelled to let go by means of a stout blow delivered on his head by the fisherman. Mr. Yarrell states that on one occasion a fishing-frog seized a conger eel that had just been hooked, when the eel wriggled through the narrow branchial aperture of his second enemy, and in this manner the two were hauled up together.

Sometimes the *lophius* attains a length of five feet, but the specimens taken on the British coasts rarely exceed three. It is of no value in itself, but is sometimes exhibited at sea-side places as a natural curiosity.

Wonders of Construction.

EHRENBREITSTEIN.

EHRENBREITSTEIN is a small town situated on the right bank of the Rhine, opposite Coblentz, of no particular interest beyond its proximity to the Prussian fortress of Ehrenbreitstein (broad stone of honour), which stands above it, and is one of the strongest fortified places in Europe. Its origin still remains unknown, but we hear of its having been inhabited many centuries ago by the Romans, and of their watch-tower, called Cæsar's Tower, which was subsequently demolished by the French, who besieged the fortress in 1688, under Marshal Boufflers, without success, although the famous Vauban directed the works against it, and Louis XIV. went thither himself to witness its surrender. It was attacked again in 1798, when the French took it after a fourteen months' siege, and on their evacuation of it at the peace of Lunéville, in 1801, they blew up its defences. Up to the early part of the thirteenth century, it served as a stronghold of the Electors of Treves, who in former times had a palace at the foot of the rock, which is now used as a flour-store. The fortress was entirely reconstructed in 1815, by some Prussian officers of the engineers, and the French gave fifteen millions of francs towards it, as they had agreed to do at the second peace of Paris, for having destroyed it; but more than four times that amount has been expended on its restoration by the Prussian government. In 1484, a well nearly 400 feet deep, and communicating with the Rhine, was built by Prince John of Baden. The platform on the top of the rock serves as a parade-ground, and covers vast cisterns capable of containing a supply of water for the garrison for three years, while the magazines are said to be extensive enough to hold provisions for 8,000 men for ten years. The escarped rocks and steep steps on three sides of the fortress are defended by many-mouthed batteries, numbering a total of 400 guns. The north-west portion of the fortification is its weakest point, and is protected by three lines of defences, constructed one within another, which must be taken in succession by the enemy before an entrance in this direction can be effected. The road up to the fortress from the town of Ehrenbreitstein, is about twelve hundred paces long; it is also fortified, and rests almost entirely upon arches built over the chasms in the rock of which the height consists. The fortress is capable of holding a garrison of 14,000 men, but in time of peace the number quartered there seldom exceeds 500.

The famous large cannon, which was made in 1528, was over 17 feet in length, and shot a ball of 160 pounds weight.

The view from the summit of Ehrenbreitstein is extensive and beautiful. For many years strangers were not admitted within the fortress without a special order from the government, but the Prussians are now less strict about these observances.

CURIOUS TREES.

EVE'S APPLE-TREES.—The botanical curiosities of the island of Ceylon are replete with varied interest. The Rt. Hon. Sir Alexander Johnston, while inquiring into the history of the country, had drawings made of a great many of the trees, plants, and other vegetable productions, to which any religious, political, or moral interest was attached by the native Hindoos, Buddhists, Mohammedans, or early Christians. One of these is "the forbidden fruit, or Eve's apple-tree," the *Tabermemontana dichotoma* of the "Hortus Kewensis." Its native name is *Diwi Kaduru*, Kaduru signifying "forbidden," and *Diwi* "tigers." The flower of this extraordinary production is said to emit a fine scent. The colour of the fruit, which hangs from the branches in a very peculiar and striking manner, is very beautiful, being orange on the outside, and a deep crimson within; the fruit itself presenting the appearance of having had *a piece bitten out of it*. This circumstance, together with the fact of its being a deadly poison, led the Mohammedans on their first discovery of Ceylon—which they assigned as the site of Paradise — to represent it as the forbidden fruit

of the Garden of Eden; for although the finest and most tempting in appearance of any, it had been impressed, such was their idea, with the mark of Eve's having bitten it, to warn men from meddling with a substance possessing such noxious properties. Its effects are so poisonous, that two European soldiers, shortly after the capture of Colombo, in 1795, being unaware of the nature of the fruit, were tempted by its appearance to taste it, and very soon sickened and died.

THE OLDEST ROSE TREE IN THE WORLD.—Humboldt in his "Aspects of Nature," relates that in the crypt of the cathedral of Hildesheim, grows a wild rose tree, said to be one thousand years old; whereas it is the root only, not the stem, which is eight centuries old, according to accurate information derived by Humboldt from ancient and trustworthy original documents. A legend connects this rose tree with a vow made by the founder of the cathedral, Ludwig the Pious; and a document of the eleventh century states that when Bishop Hezilo rebuilt the cathedral, which had been burnt down, he enclosed the roots of the rose tree within a vault which still exists, raised upon this vault the crypt, which was reconstructed in 1061, and spread out the branches of the rose tree upon the walls. The stem was, in 1849, 26½ feet high, and the branches covered about 32 feet of the external crypt wall. This is considered to be the oldest rose tree in the world.

THE WONDERFUL POWER OF RESISTING FIRE.

EVERYBODY has heard of the wonderful power which some persons have possessed, or pretended to possess, of resisting the action of fire. The truth is, that it is now quite possible to account in a rational manner for genuine cases of this kind. Other performances, apparently still more wonderful, are the results of trickery, and as a juggling trick loses all its interest when once the truth is told concerning it, we will explain one of these marvels, and then pass on to those much greater marvels of the same kind which admit of a scientific elucidation.

The performer shows his audience an iron spoon, empty, and immediately dipping it into a vessel full of what appears to be melted lead, shows it again filled with the molten metal. He then puts the spoon into his mouth, and on withdrawing it from between his lips shows the spectators that it is empty. In a few moments—during which time his lips are compressed as if he were painfully holding the metal between his teeth till it cooled—he takes from his mouth a solid piece of lead with the marks of his teeth moulded in it. To all appearance the juggler has taken into his mouth a spoonful of melted lead, and held it between his teeth till it became solid. In reality his spoon has a hollow handle containing quicksilver, which he allows to run out into the bowl, when he pretends to dip it into the lead, and which runs into the handle again, and leaves the bowl of the spoon empty, when he pretends to put it into his mouth. The piece of solid lead which the performer exhibits has, of course, been prepared beforehand, and kept ready in his mouth.

The explanation of this apparent wonder must suffice as an example of many similar explanations, applicable to juggling tricks with fire. The facts we are about to mention are of quite a different character.

Readers of history are well acquainted with the general nature of the Ordeal by Fire, a form of appeal to Divine judgment in the Middle Ages. Either red-hot ploughshares were prepared, on which the accused was doomed to walk, or he had to carry a piece of red-hot iron in his hand a certain distance. All persons except the priest and the accused were prohibited from entering the church after the fire, in which the iron was to be heated, had been kindled; and when the iron was red-hot, it had to be taken in the hand and carried over a space nine times the length of the accused's foot. If boiling water was chosen by preference, the hand had to be plunged in it to the depth of the wrist, in the simpler cases, and in the severer trials, to the depth of the elbow. After either ordeal, the hand was bound up and sealed by the priest, and not inspected till the end of three days. It is obvious that these regulations admitted of fraud, but it will be shown before we conclude, that it was by no means physically impossible for the accused to escape unhurt, even when the experiment was fairly tried.

It would fill many pages were we to record all the instances in which fire has been handled with impunity. Amongst others there is the story of the Augustinian father and the Jesuit.

After a contest of words, in which the latter was worsted, he offered to settle the matter by giving miraculous proof of the greater sanctity of his order. Then turning to one of the monks, he said, "My hands are cold, Brother Mark, fetch me some fire from the kitchen to warm them; and do not stay to put the burning coals in a chafing-dish, but just bring them, brother, in your hands." Mark left the room cheerfully, and presently came back with his hands full of burning coals, which he held without any signs of pain, until his superior had warmed himself, and then quietly carried them back. In comparatively recent times the same daring has been exhibited by performers. In the year 1680, an Englishman named Richardson went the round of Europe in the character of a fire-king. He chewed and swallowed burning coals, ate molten glass, drank a flaming composi-

tion of pitch and sulphur, and held the heater of a box-iron in his mouth. In the early part of the present century a woman performed similar feats in the metropolis: it is stated that she stood with her naked feet on a plate of red-hot iron and washed her hands in boiling oil.

In some of these cases the power of resisting fire was obtained by hardening the skin with certain chemical preparations. The scientific explanation of others was discovered by M. Boutigny, who made a special study of what he called *the spheroidal state of bodies*, and proved experimentally, in his own person, that it is possible to plunge the hand into molten lead and yet sustain no injury. The first edition of M. Boutigny's work was published in 1842, and in it he demonstrated the remarkable fact, that there is no actual contact between bodies in the spheroidal state and the surfaces on which they appear to rest. To make this statement intelligible, let *a*, Fig. 1, be a lump of silver or platinum, egg-shaped, and weighing about half a pound or less. Having been made as hot as possible, it is suspended in water by means of the hooked rods, *b c*. What we affirm is, that the metal, *a*, will not be in actual contact with the water, but that the water will recede from it as represented in the engraving. Or, again, let *a b*, Fig. 2, be a well-polished capsule of iron kept at a red heat by the lamp beneath it. Let fall into this capsule or tray a few drops of cold water, and they will immediately collect together in the form of a spheroid, *c*, which has the appearance of trembling. This tremulous motion is caused by the vapour which escapes from the bubble, and which is interposed between it and the red-hot plate, like a spring-cushion, though invisible. That there is no contact can be proved by blackening the water before it is dropped: the light of a candle can then be distinctly seen through the thin stratum of vapour, as represented in the engraving, though of course, the distance between the spheroid of water and the capsule is exaggerated.

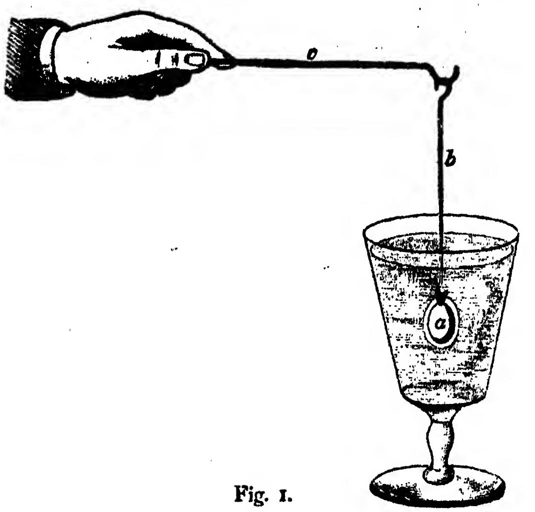


Fig. 1.

The theory for our purpose is this: the hand of the operator, having been very carefully moistened with a very volatile liquid, such as alcohol or ether, is to be plunged rapidly, and with a certain kind of adroitness, into the molten metal. In some cases the natural humidity of the skin, especially when the operator is influenced by some terrible apprehension, may do as well. The moisture, however produced, is thrown by its sudden contact with the heated metal into the spheroidal state, and as a necessary consequence there is no actual contact of the hand with the metal, but a thin layer of vapour is interposed between them. In order for the spheroidal state to be assumed, a certain limit of temperature must be exceeded, which differs for different bodies: that of water must be below the boiling point. If, after having obtained the spheroidal globule, the vessel or capsule be allowed to cool, the liquid immediately touches it and *boils*. Occasionally explosions take place in steam-boilers, which can only be accounted for on the presumption that the water had assumed the spheroidal state, and that the heating of the boiler had then ceased, and an amount of steam been generated which the boiler was not strong enough to resist.

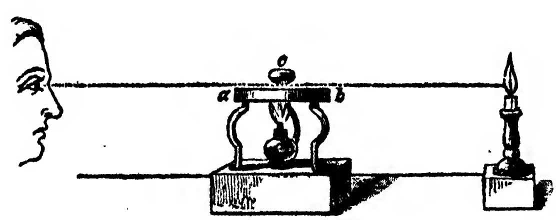


Fig. 2.

The theoretical explanation here given has been experimentally verified by Boutigny, who plunged his own hand into molten metal; and other savans have done the same thing to prove their confidence in the scientific principle. Glass-blowers avail themselves of the same law when they fashion a mass of incandescent glass in water by turning it rapidly round, and blowing through the rod from which it is suspended. A bubble is thus formed in the midst of the pasty mass, and a little water being introduced into it, and the opening closed, the vapour of the water expands the bubble because it cannot escape, nor even enlarge itself otherwise. If the water were not in the spheroidal state when this is done, and were really in contact with the glass, an explosion would take place.

WHITE ANTS AND THEIR DWELLINGS.

THE WHITE ANT FAMILY.

THE Termites, or white ants, as they are often called, though they have little affinity with the true ants, are chiefly confined to the tropics; some few species, however, extend into the temperate regions. Like the bees, wasps, and ants, which live in society, the termites are composed of three kinds of individuals—males, females, and what are termed neuters or workers. The larvæ nearly resemble the perfect insect, excepting that they possess no wings. The pupæ have rudimentary wings. The neuters differ from the males and females in possessing no wings, in having the body stouter, the head much longer and provided with long jaws crossing at the extremity; they are said to defend their nests, and station themselves near the outer surface; they are the first to make their appearance when their habitation is disturbed; they will attack their assailants, and bite with considerable strength. The negroes and Hottentots consider these insects a great delicacy. They are destroyed with quick-lime, or more readily with arsenic, which is thrown into their habitations.

The fullest account we have of these remarkable creatures is that related by Smeathman in the *Philosophical Transactions*, 1781. They destroy all timber in buildings, all furniture, and nothing

escapes them but metal or stone. They construct their nests with covered galleries, and far surpass our European ants, bees, wasps, or beavers, in the art of building, and in sagacity and government.

There are several species, and some build on the ground, others on the branches of trees, often at great heights. The largest species (*Termes bellicosus*) is best known on the coast of Africa. It erects immense buildings of well-attempered clay. In Senegal they resemble the villages of the natives, being ten or twelve feet above the level of the ground, and like very large haycocks. Comparing the size of the animal with that of man, these buildings are to the ants what four or five times the height of the Monument would be to us.

Every building consists of two parts, an exterior dome and an interior, divided into an amazing number of apartments. The exterior is a protection from the weather, and in the interior reside the king and queen, and the whole community, with magazines stored with provisions and conveniences. They raise these immense structures in separate turrets, of the shape and size of sugar-loaves, and then fill it between till the dome is completed by joining the tops of the lofty turrets which they raise in the centre. They then take away the bases of the central turrets, and apply the clay to the construction of the interior.

The royal chamber is in the centre, in the shape of a large oven. The entrances are so small, that the king and queen can never leave it. Around it are apartments for soldiers and attendants, and magazines filled with gums and hardened juices of plants. Among these are the nurseries for the eggs and young. Beneath are sewers to carry off water, descending to the gravel; here subterraneous passages are carried horizontally to vast distances, like passages from old castles, from which they emerge on any building or merchandise they intend to attack. As they cannot carry up perpendiculars, all the ascents and descents are made by spiral roads. For a communication inside they construct elliptical bridges.

Their destructiveness is very methodical. They destroy all the softer substances first, and are particularly fond of pine boards, eating away the entire inside, and leaving the surface as thin as paper. A stake in a hedge is their sure prey, of which they leave only the bark, and if the bark fall off the outside of a beam, they cover it with their mortar, so that no one suspects the attack till the articles are handled or a support gives way. Fallen trees they perforate in like manner; and what appears to be a sound piece of timber, often proves but a shell which may be crushed by the fingers. They seem aware that if their work were seen from without, they should be disturbed, so that the mischief is never suspected till it is perpetrated. Of deserted houses or villages they leave not a vestige in a few weeks.

The ravages of white ants continue to be as destructive as when Smeathman described them. In the island of St. Helena, the white ants were, it is supposed, accidentally introduced from the coast of Guinea, about twenty years since. Jamestown was devastated, the cathedral and the books of the public library were destroyed. Everything in the town made of wood was more or less injured, imperilling the lives of large numbers of the 4,000 inhabitants. In the government stores it was found that the moist traces of the insect on the outside of the tin cases caused very speedy corrosion of the metal, and enabled the insects to make their way in and devour the contents, doing many thousand pounds' damage. The governor of St. Helena applied to the Lords of the Admiralty for the best mode of finding the ants' nests, and effectually destroying them; and also as to the description of timber which has proved to be the least susceptible of injury from the insects; these inquiries having been referred to General Hearsey and the Entomological Society, it has been decided that the nests must be sought in the plains; that if the ants once effected a lodgment in the walls of a house, the walls themselves must be taken down before the insects could be got rid of. Steeping timber in a solution of quick-lime, will prevent the attacks of the insects, and impregnating the timber with creosote has been found a preservative. In Western Australia, where white ants abound and destroy all buildings and furniture to a great extent, the wood of the mahogany tree has been found proof against the ants' attacks; while in the Amazon country, where the house walls consist of posts with crossed laths filled up with mud, and covered with lime and cement, the houses, if washed over with a solution of arsenicated soap, will be preserved from the insects' attacks.

Wonders of Mechanical Ingenuity.

EXPANDING MODEL OF A MAN.

In the Great Exhibition in Hyde Park, in the year 1851, was shown a mechanical curiosity—an expanding model of a man—the construction of which has a romantic interest. It was the invention of the Polish Count Dunin, who, in early life, became involved in the insurrection of his countrymen, and was banished. In his dreary exile he betook himself to mechanical pursuits, that he might expiate his offence, real or imaginary, against the emperor of Russia, by showing that he could be useful if he were restored to his country.

The model represents a man five feet high, in the proportions of the Apollo Belvidere. From that height and size it can be proportionally increased to

eight feet eight inches; and as its use is to measure the clothing of an army, it is capable of expansion and contraction in all its parts. The internal mechanism is completely concealed, the figure externally being composed of thin slips of steel and copper, by the overlapping of which, expansion or contraction is exercised, the motion being communicated by thin metal slides within the figure, these slides having pins worked in curved grooves in circular steel plates, which are put in revolution by a train of wheels or screws. A winding key, turned right or left, effects the expansion or contraction noiselessly, and in the direction of the fibres of the muscles of the living subject. The mechanical combinations are composed of 857 framing pieces, 48 grooved steel plates, 163 wheels, 203 slides, 476 metal washers, 488 spiral springs, 704 sliding plates, 497 nuts, 3,500 fixing and adjusting screws, with numerous steadying pins; so that the number of pieces is upwards of 7,000. For this beautiful piece of mechanism a Great Exhibition Council Medal was awarded to the inventor, Count Dunin.

WONDERFUL JEWELLERY.—A Parisian jeweller makes brooches and other ornaments in which mechanical movements are introduced and set in action by very small galvanic batteries, which are concealed in some part of the wearer's dress. The moving object may be a rabbit, which is made to strike a bell with drumsticks; the head of a skeleton with rolling eyes, and a mouth that opens and shuts; a grenadier beating a drum; a monkey playing the fiddle; or a bird moving its wings as if in the act of flying. The batteries are constructed of minute slips of zinc and platinum, or zinc and carbon, which act in the same manner as the larger arrangements of the same kind used for ordinary purposes.

Wonderful Relics.

THE EARLIEST KNOWN FOSSIL.

THE oldest type of organic life yet known to the geologist is the Eozoon, lately discovered in Canada, and brought to England by Sir William Logan. It is more perfect than any previously found, but would have been taken for a coral had it not been for the evidence of its microscopic structure. It is termed a *rhizopod* (from two Greek words, *root* and *foot*), a name proposed by Mr. Dujardin for a new class of animals of a lower degree than the radiata, possessing the power of locomotion by means of minute tentacular filaments. The skeletons of this rhizopod seem to have greatly extended themselves over the surface of all submarine rocks, their base frequently reaching a diameter of twelve inches, and their thickness being usually from four to six inches. These masses, occurring in homogeneous limestone, exhibit, more or less, regular alternation of calcareous or siliceous layers. Dr. Carpenter has determined by the microscope the minute structure of this organism, which, he says, in its living state might be likened to an extensive range of buildings, made up of successive tiers of chambers, those of each tier generally communicating very freely with each other. The walls of these chambers are everywhere formed of a vitreous, pellucid, shelly substance, minutely perforated with little parallel tubes, which are so penetrated by siliceous infiltration, that when the calcareous shell has been removed by acid, the natural cast of their cavities remains in the form of very delicate needles, parallel to each other, on the solid mould of the cavity of the chamber, over which they form a very delicate layer.

This discovery of the Eozoon is of the highest importance, occurring, as it does, in strata that were formed at a period inconceivably antecedent to the pre-supposed introduction of life upon the globe, and displacing the argument derived from the supposition that at the dawn of life a multitude of beings of high organisation were simultaneously developed in the Cambrian and Silurian strata.

EDUCATED FLEAS.

SOME years ago a strange little man, with a quaint-looking box, used to take his stand in various parts of London as soon as it was dusk, during the winter months, and silently invite the passing crowd to stay and take a peep into this quaint-looking box, which was lighted by a candle placed inside of it, the light of which shone through various coloured papers, and exhibited a transparent description of the object for which he hoped to gather halfpence—"A flea chained up by the neck, alive." The fee for viewing the flea undergoing this strange imprisonment was "one halfpenny," and a convenient magnifying-glass was let into the side of the quaint box, in order that the object exhibited might be the better viewed. The writer of the present article has paid more than once to see this unusual sight, until he came to be regarded by the proprietor of the imprisoned pulex as a regular customer, and was treated to a sight of "sucking" fleas undergoing the process of training. Some were very quick, according to his account, and "others he could make nothing of." The chains, cars, and locks which these little beasties drew were of silver, and, as the strange little man said, all constructed by himself. He had one flea who had been with him twenty-six months, and declared that he knew of still older ones, and he was accustomed to feed his fleas, twice a day, by allowing them to suck from the back of his hand. He declared that he was the last man who possessed the secret of educating these lively insects.

In 1829, on the ruins of the houses taken down to make the new approaches to London Bridge, on the Southwark side, another man exhibited by candle-light two fleas, one drawing a kind of car and the other a lock and chain. This they appeared to manage with the greatest ease.

In Nottingham also, in the same year, there were two fleas shown, who had gold chains about their necks. One of them drew a carved cherry-stone, and the other a silver cannon. There was also an exhibition in London about the year 1845, of some "industrious fleas." One flea had a chain made of nearly 700 links, the whole of which was little more than a span long, but it was sufficient to restrain the flea's furious leaps he made in trying to escape. This chain also had a padlock and key curiously wrought, the whole of which only weighed a grain. In the same exhibition were two other fleas drawing a chariot, three were dragging an omnibus, and two military fleas were fastened to a brass cannon of proportionate size.

The street exhibitor, the strange little man with the quaint-looking box, was in the habit of visiting public-houses with a view to increase his income, but one night, yielding to strong temptation and strong liquor at the same time, his quaint box got broken, his fleas escaped and fled on their own account, to "seek fresh fields and pastures new," and so the educated fleas were lost to the world, and it has never since been our good fortune to light upon a similar exhibition, and perhaps they are persuading their brethren in a wild state that chains about the neck are the ornaments and clothing proper to all civilised and educated fleas.

THE MASCARET.

At the mouth of the River Dordogne, in France, there is occasionally observed a natural phenomenon which is witnessed on no other river in Europe. When the waters of the Dordogne are low, and especially in summer, a hillock of water, about the height of an ordinary house, suddenly rises at the confluence of the river with the Garonne. It spreads and rolls along the bank, ascending the sinuous windings of the river with extraordinary rapidity and fearful noise. All that comes in its way on the bank on which it moves yields to its fury. Trees are torn up, barges sunk, and stones are often driven to the distance of fifty paces; all fly from it with consternation, and cattle, even, with what seems a sudden instinct. It sometimes takes the centre of the river, and changes its shape. The watermen are usually able, by observation, to discover its approach, and thus escape certain destruction.

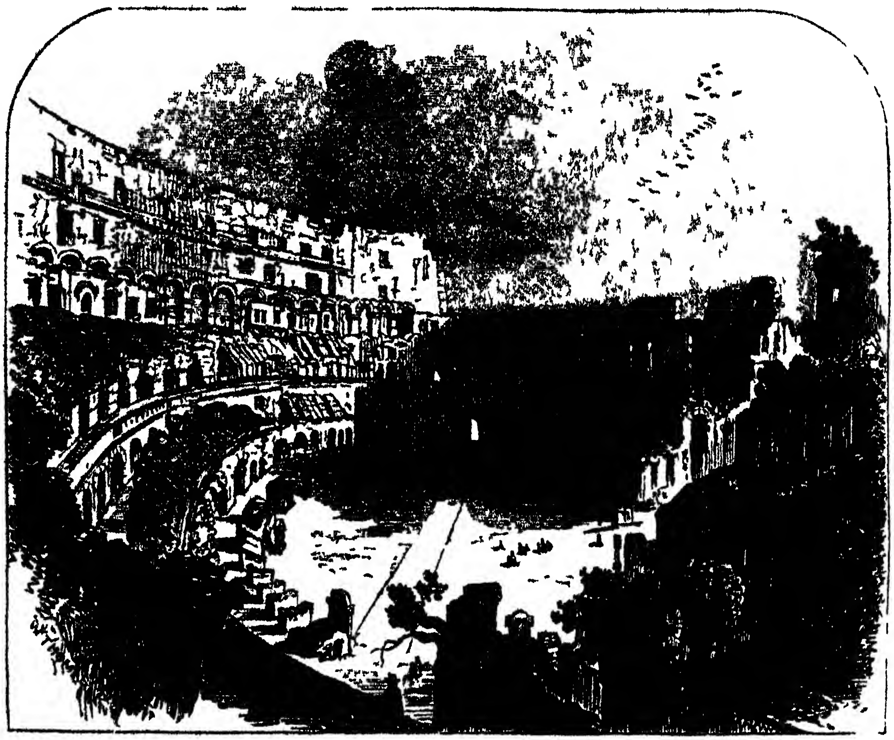
The cause of this phenomenon, which is called the *Mascaret*, is as follows:—The tide flows from the estuary, known as the Gironde, towards the two rivers Dordogne and Garonne. The former is right in the direction of its straight course, while the latter is angular and divergent; and hence the Dordogne receives a disproportionate quantity and impulse of the water. The impediments which the Mascaret meets as it ascends the Dordogne, from sand-banks, &c., and the rapidity of the opposing current, all tend to increase its force and fury, and its velocity at last becomes so great, that not a moment must be lost by him who would observe it.

Wonders of Construction.

THE COLISEUM.

Among the many stupendous architectural works of antiquity which surprise us by their extent, their beauty, and the wonderful difficulty of their construction, the Roman Coliseum stands out pre-eminent. Its ruins refuse to perish, and there they stand in colossal majesty, the astonishment of all beholders. As will be seen by the annexed drawing, the Coliseum was an amphitheatre, of which the external walls consisted of four tiers of arcades, adorned with columns of the Doric, Ionian, Corinthian, and Composite orders. The internal circumference was 1,600 feet, and the accommodation provided seats for over 80,000 people. On fair authority it is stated that the Emperor Vespasian caused this theatre to be built, occupying 30,000 captive Jews in the erection of it. It does not seem, however, to have been completed in Vespasian's reign. Titus, the destroyer of Jerusalem, was he who had the gratification of opening it for Roman sports; and it is said that on the opening day he caused over 5,000 wild beasts to be introduced into the arena, and compelled captive Christians to fight with them. Vast cells, or rather ranges of cells, were constructed under the spectators' galleries, for the reception of the wild beasts, panthers, leopards, pards, and lions, which were the combatants in these cruel pastimes. There were also gigantic reservoirs of water containing such supplies, that when occasion required, the floor of the Coliseum could be flooded from them to the depth of several feet; and on the opening day, after the Christians and the beasts had afforded pleasure to Rome, the entire floor was covered with a sheet of water upon which two mimic squadrons performed their evolutions, and went through the performance of a sham naval engagement.

For many years the Coliseum was the one great public recreation-place in Rome. Successive emperors exerted themselves to maintain it in all its original splendour, and enormous were the sums of



RUINS OF THE COLISEUM.

money annually expended upon repairs, and in keeping up the performances. When the Goths sacked Rome they spared the amphitheatre, and until the removal of the seat of imperial government to Constantinople, the Coliseum was preserved in all its integrity. After that event the purposes for which the Coliseum was built were no longer desirable—Christian bishops ruled where pagan emperors had dictated, and the ecclesiastical government was averse to all plays, games, and spectacles—except where it chose specially to have them. The Coliseum's occupation was gone, and its great bulk, and the great store of stone contained in it, proved obnoxious to the desires of certain dignitaries, who, being without palaces, thought the Coliseum might worthily be utilised in furnishing the materials for building them. So the Coliseum served in lieu of a quarry. Paul II. built St. Mark's Palace, Paul III the Farnese Palace, out of materials from the great theatre, and other prelates and church princes followed the bad example, till something like half of the Coliseum was swept away, what remained being spared not so much on æsthetic grounds as because of the hugeness of the blocks, which resisted all the efforts of the indolent Italians to move them. On the floor where Corcyrian and Corinthian fleets had manœuvred, great quantities of débris were piled up, so that in course of years the interior was choked with rubbish above the lower galleries on which enthusiastic spectators had sat and applauded.

When Pope Pius VII was dethroned and taken prisoner by Napoleon I, the Coliseum, in common with many other Roman buildings, was cleaned and cleared The channels which conducted the water for the aquatic exhibitions, the iron gates which were opened to admit the wild beasts to the arena, and the bronze rings to which the Christian martyrs were chained, were brought to light It is not possible to say how far the French emperor would have gone on the road of restoration had he continued to direct the fortunes of Italy He dug out old Rome during the short time his engineers were in the city, and disclosed in all their beauty and reality some of the most splendid monuments of the past. But as soon as the churchmen got back, they undid no small portion of the great emperor's work, actually refilling a large part of the interior of the Coliseum in order to render certain chapels in and about it more accessible

The splendid ruins themselves remain as Napoleon left them; and it is possible they may outlive the ecclesiastical dominion which has despoiled them, as they have outlived the imperial dominion which caused their origin.

THE LADY OF THE HAYSTACK.

In the year 1776 a young woman suddenly made her appearance at the village of Bourton, near Bristol, and attracted universal attention by the strangeness of her life. Young and beautiful in person, and graceful in her manners, she nevertheless lived a desolate life for four years, without knowing the comfort of a bed, or the protection of a roof. Her place of refuge was a haystack, to which she fled with a kind of wild rapture when remonstrated with, or when any attempt was made to restrain her actions. The ladies of the neighbourhood supplied her with the necessaries of life, but she would neither wear, nor, indeed, accept of any finery or ornaments. When such things were forced upon her, she hung them on the bushes, as being unworthy of her attention.

Her exposed manner of life had gradually undermined her health and impaired her beauty, before, after repeated trials, she was prevailed upon to remain under the care of Mr. Henderson, the keeper of a private asylum, where she was supported by the benevolent Mrs. Hannah More and her sisters. As her health improved, it became more and more evident that her intellect was impaired. She spoke English with a German accent, but every attempt to inquire into her history was baffled either by her reticence or her increasing idiocy. A gentleman spoke to her in German, when her emotion was so great that she turned from him and burst into tears.

The circumstances under which she had been found, and every slight suggestion that could be gathered from repeated conversations with her, were published in German and French throughout the Continent, but led to no result till the year 1785, when a pamphlet appeared in the French language, without either name or place which might serve as a clue to its authorship, under the title of "The Stranger: a true History." From this pamphlet the following particulars of a strange story are derived, and when we have recited them, the reader must judge for himself whether the Lady of the Haystack and the young lady described in the pamphlet were one and the same person.

In the year 1768 (the French pamphlet relates) a letter was received from a lady at Bordeaux by Count Cobenzel, the Austrian minister at Brussels, entreating for the writer his advice and assistance, and signed, in very indifferent French, (Mademoiselle) La Frülen. Not long afterwards the count also received a letter from Prague, signed Count J. Weissendorf, in which he was entreated to comply with Mademoiselle's request, and even to advance her money. The letter concluded thus:—"When you shall know, sir, who this stranger is, you will be delighted to think you have served her, and grateful to those who have given you an opportunity of doing so."

A third letter came to the minister's hand from Count Dietrichstein, of Vienna, urging the same request, but at the same time desiring him to advise Mademoiselle to be frugal in her expenditure. The count replied to the last two letters, but got no rejoinder, and in the meantime he continued the correspondence with Mademoiselle La Frülen at Bordeaux, who finally stated that she could not entrust her secret to writing, but that she intended to visit the Austrian Netherlands, and would see him personally. She meantime sent him her portrait, in which the count saw nothing more than the features of a lovely woman, while Prince Charles of Lorraine declared that it bore a strong resemblance to the late emperor, his brother.

The pamphleteer continues the account of the circumstances which followed, with much detail. Despatches from Vienna led to Mademoiselle's arrest. It appears that while Joseph II. was on his travels in Italy, the king of Spain had received a letter, purporting to be written by the emperor, and informing him in confidence that his father had left a natural daughter, whose history was known only to his sister, the Archduchess Marianne, himself, and a few intimate friends. The king of Spain thought this letter so extraordinary that he sent it to the emperor. Its authorship was denied, and, as a consequence, Mademoiselle La Frülen was arrested and conveyed to Brussels.

It is as strange as the other particulars of this strange story, that just before she quitted the French dominions, a person unknown, in the habit of a courier, put a note into her hand at the coach-window, and then retired with the utmost precipitation. The officer by whom she was accompanied read the note, which contained only these words: "My dear girl, everything has been done to save you; keep up your spirits, and do not despair." She afterwards declared that she neither knew the courier nor the handwriting.

At Brussels, notwithstanding her winning appearance and engaging manners, she was subjected to the severest tests. She spoke French with a German accent. Details of her early history were extracted from her, which are all related in the pamphlet. She had understood that Bohemia was the name of the country in which she had been brought up, in the care of two ladies, one of whom she had been accustomed to call "mamma," the other Catharine; she had also received instruction from an ecclesiastic who frequently visited the house. She described certain visits made at distant intervals by a handsome gentleman in a hunting suit, beneath whose riding coat she once noticed something red. At one time this visitor was expected, but did not come; and he afterwards accounted for his absence by explaining that he had been ill in

consequence of overheating himself in the chase. Prince Charles recollected that at the time corresponding to this statement the emperor was actually taken ill on his return from hunting.

Then came the time when she heard of the strange gentleman's death, which corresponded with that of the emperor's; and La Frülen related a long story about her removal from Bohemia, and from the companionship of the two ladies, by the ecclesiastic. In some particulars of this part of her story she was convicted of prevarication; but then, again, confirming circumstances occurred. Unexpectedly seeing a portrait of the late emperor, she was so affected by it that a long and serious illness ensued. The result of her alleged removal from Bohemia was her settlement at Bordeaux, where she lived luxuriously; and there she most certainly forged letters as a means of recommending herself to the Duke de Richelieu. These acts she did not conceal from her examiners, but declared, with all the appearance of simplicity and frankness, that forsaken as she was, and certain as she felt of her parentage, she did what she had a right to do for her own protection. Before any conclusion was come to concerning her, Count Cobenzel died, and from what he told a friend, there is reason to believe he was more than half satisfied of the substantial truth of her representations. Mademoiselle was then liberated from prison, fifty louis d'ors were placed in her hands, and she was turned adrift in the "wide, wide world." This was in 1769, and if she was the same person afterwards discovered at Bristol, and known as the "Lady of the Haystack," there is an interval of seven years which it is but little likely will ever be accounted for in her sad history. Considering the condition in which she was found, the story would probably be one of hopeless wandering from place to place until her reason was impaired.

The Lady of the Haystack had been named Louisa by her benefactors, but there are so many coincidences in what little she related, and in her manners, with the story of La Frülen, that it is almost impossible to resist the conclusion that we are reading the history of the same person. Two scars which marked her person corresponded with the description given of the stranger by the pamphleteer, and her beautiful features, with a touch of "the Austrian lip," further established her identity. When sudden remarks were purposely made, there were proofs given in her manner that she had been accustomed to luxurious living, and to riding in a carriage. Besides this but little remains to relate of her. After remaining for a considerable time under the care of Mr. Henderson, Louisa was removed, as incurable, to Guy's Hospital. As years passed on, the contraction of her limbs, from exposure to cold in the fields and from her subsequent inactivity, rendered her an object of the strongest compassion. She died rather suddenly, after a long illness, on the 18th of December, 1801, and on the 23rd her remains were interred in the hospital grounds, at the expense of Mrs. More.

Medical Wonders.

Remarkable Recovery of Lost Voice.—In the beginning of December, 1801, Elizabeth Sellers, a scholar in the Girls' Charity School at Sheffield, aged thirteen years, lost her voice, insomuch that she was unable to express herself otherwise than by a whisper. She, however, enjoyed very good health, and performed several employments in the school, such as knitting, sewing, and spinning. She was unable to read audibly, and her infirmity resisted all attempts at cure. One evening, hearing several of her schoolfellows singing a hymn, and being desirous to join them in their devotion, she whispered to one of her companions, requesting her to shout violently down her throat, which being complied with, she immediately recovered her voice to its fullest pitch. By her account, the sensation was like that of having a lump in her throat, which, as she rightly conceived, might be broken by the shout.

An equally remarkable story is told by Charles Dickens in his Life of Grimaldi of a sailor who had lost the power of speech from some illness, suddenly recovering it in the theatre from the excitement and intense amusement he experienced from witnessing the drolleries of the celebrated clown. Whether this account is true we cannot undertake to say, but it is related by Mr. Dickens as an undoubted fact, about which there seemed no question at the time of its occurrence.

Idiocy produced by strong Mental Emotion.—Dr. Abercrombie, in his celebrated work on "The Intellectual Powers," gives some very striking examples of this kind. He remarks that idiocy "is a simple torpor of the faculties, in the higher degrees amounting to total insensibility to every impression; and some remarkable facts are connected with the manner in which it arises without bodily disease. A man mentioned by Dr. Pinel was so violently affected by some losses in trade, that he was deprived almost instantly of all his mental faculties. He did not take notice of anything, not even expressing a desire for food, but merely taking it when it was put into his mouth. A servant dressed him in the morning, and conducted him to a seat in his parlour, where he remained the whole day with his body bent forward and his eyes fixed on the floor. In this state he continued nearly five years, and then recovered completely and rather suddenly. The account which he afterwards gave of his condition during this period was, that his mind was entirely lost, and that it was only about two months before his final recovery that he began

to have sensations and thoughts of any kind. These at first served only to convey fears and apprehensions, especially in the night-time. Of mental derangement produced in the same way by a moral cause, an affecting example is also given by Pinel. Two young men, brothers, were carried off by the conscription; and, in the first action in which they were engaged, one of them was shot dead by the side of the other. The survivor was instantly struck with perfect idiocy. He was taken home to his father's house, where another brother was so affected by the sight of him that he was seized at once in the same manner, and, in this melancholy state, they were both received into the Bicêtre (a French hospital for lunatics, &c.). For the production of such an extraordinary result, it is not necessary that the mental impression should be of a painful description. Pinel mentions an engineer who, on receiving a flattering letter from Robespierre respecting an improvement he had proposed in the construction of cannon, was struck motionless on the spot, and soon after conveyed to the Bicêtre in a state of complete idiocy."

MOUNTAIN RAILWAYS.

MANY ingenious devices have been employed for the purpose of carrying railway traffic over the face of mountains, where it has not been thought necessary or practicable to tunnel them. While the great railway through Mont Cenis was in progress, one of these contrivances, known as Fell's Climbing Rail, was adopted to traverse the mountain, and by its means the Alpine pass from St. Michel to Susa, a distance of forty-nine miles, was accomplished in about five hours. The line was used both for passenger and for goods traffic. The principle on which it was constructed was the adoption of a centre rail between the two ordinary rails, and a means of making the locomotive grasp this rail, and cling closely to it while still pursuing its upward path. For this purpose two horizontal wheels were adjusted to the locomotive, and these fitting into two grooves, one on each side of the centre rail, were pressed against this rail by powerful springs, which bound the engine and its carriages closely to the line, while the outer rails were traversed by wheels working in the ordinary fashion.

The ascent of the mountain by this railway began at an elevation of about 2,500 feet above the sea level, and rose to a height of nearly 7,000 feet, by a succession of curves and zigzags, resembling a winding staircase. During the first twenty-four miles of the line the mean gradient or incline was 1 in 60, and the maximum 1 in 12; while in the second half of the line the mean gradient was as high as 1 in 17, the maximum being the same. The sight of an engine, with a trainful of passengers, climbing up a steep ascent of this description was a most remarkable one. On the line itself, to look down from the train when near the summit was something like looking from a balloon. Four zigzags were visible at the same instant to a depth of 2,000 feet. Add to the sublimity of this the features of the surrounding scenery, the snow-clad peaks and glaciers rising to an elevation of from 10,000 to 13,000 feet, and some idea may be formed of the sentiment which the passage of Mont Cenis by the Fell Railway was likely to inspire—a sentiment widely different to that which now strikes the traveller as he is carried by the new line through the heart of the mountain.

The Fell Railway was opened in June, 1867, and it ceased working when the tunnel route was completed, the permanent way used for it being then taken up. Within the last two or three years, however, a similar line has been in operation for the ascent of the Righi—a well-known mountain range in Switzerland, upon the Lake of Lucerne. Here, again, the principle of the centre rail is adopted, but this rail is constructed with small hollows at equal distances along its surface, into which hollows cog-wheels are made to work as the locomotive ascends, and thus the tendency to recede is prevented. The summit of the Righi is 6,000 feet above the sea, and the total distance traversed by the railway in its zigzag path up the mountain is about five miles. Travellers ascend the Righi for the purpose of enjoying the magnificent view it affords of Alpine scenery. The Righi range stands alone among the mountains, and from its position has been compared to a natural observatory, from whence on all sides the most beautiful views of Switzerland and the Alps may be obtained. The lower and middle portions of the range are clad with forests, and the upper parts consist chiefly of excellent pasture-ground, where about 2,000 head of cattle usually graze in summer. The highest point is called the Culm, and is a large space of ground covered with turf, on part of which an inn has been erected for the accommodation of travellers, some of whom ascend the mountain towards evening, and stay a night at the hotel, for the purpose of obtaining a view of the glorious prospect which the break of day here reveals. The horizon is said to extend to a circumference of 300 miles, including the range of mountains of the Black Forest in Germany, and that of the Jura from Geneva to Basle.

The ascent was formerly accomplished on foot or by means of mules, several good paths being available for the purpose; but few persons now prefer either of these tardy and toilsome methods to the ready access to the summit which the railway affords. The locomotive on the Righi Railway takes up one carriage only, accommodating about twenty-four persons.

SOUNDING STONES AND SPEAKING HEADS.

THE ancient magicians appear to have been very successful in turning to their purposes the properties of sound. In the labyrinth of Egypt, which contained twelve palaces and 1,500 subterranean apartments, the gods were made to speak in a voice of thunder; and Pliny, who lived at this time, informs us that some of the palaces were so constructed that their doors could not be opened without the peals of thunder being heard in the interior. Darius Hystaspes used to impress the divinity of his character upon his subjects by the bursts of thunder and flashes of lightning which accompanied their devotions; and it is thought that in the subterraneous and vaulted apartments of the Egyptian labyrinth, the reverberated sounds arising from the mere opening and shutting of the doors themselves afforded a sufficient imitation of ordinary thunder to impose upon the credulous worshippers. Sir David Brewster conjectures that the method used in our modern theatres was known to the ancients. This is to shake a piece of sheet iron horizontally, so as to agitate the corner in a direction at right angles to the surface of the sheet, by which the deep growl of distant thunder, as well as the loud and explosive bursts which rattle over our heads, may be produced. The same effect may be produced by sheets of tin-plate and thin plates of mica, but the sound is shorter and more acute. Imitative lightning is produced by throwing powered rosin, or the seeds of lycopodium, through a flame; and rattling rain is imitated by a shower of peas in a sort of drum.

VIEW OF THE STATUES OF MEMNON.

The ancients turned to account the acoustic properties of certain kinds of stones in a remarkable way. Pausanias tells of a marvellous stone that was placed as a sentinel at the entrance of a treasury, and that robbers were scared away by the trumpet tones which it sent forth. Several stones have this property of resonance, and it is probable that a stone of this description was so suspended as to be struck by a projecting piece of metal when the external door of the treasury was opened. Strong boxes or safes have been known to emit sounds to alarm their owners when broken into surreptitiously. M. Salverte relates that Louis XV. possessed one of these, and that Napoleon I. was offered one at Vienna in 1809; and there have been made similar boxes which, when opened by a false key, throw out a battery of cannon and shoot the invader.

The clink-stone indicates by its very name its sonorous qualities. The red granite of the Thebaid, in Egypt, possesses similar properties; and so musical are the granite rocks on the banks of the Orinoco, that their sounds are ascribed to witchcraft by the natives. In Brazil, travellers have seen large blocks of basalt which emitted very clear sounds when struck; and the Chinese employ this stone in the fabrication of musical instruments. Several years since, an artisan of Keswick exhibited a "Rock Harmonicon," composed of slabs of stone placed at certain distances apart, and upon which, when struck, were performed different pieces of music.

But the most celebrated of these acoustic wonders is the "Jabel Nakous," or "Mountain of the Bell," a low sandy hill in the peninsula of Mount Sinai,

in Arabia Petræa, which gives out sounds varying in power from that of a humming-top to thunder, while the sand, either from natural or artificial causes, descends its sloping flanks.

The late Hugh Miller, the geologist, observed an analogous phenomenon in our own country. When in the island of Eigg, in the Hebrides, he observed that a musical sound was produced when he walked over the white, dry sand of the beach. At each step the sand was driven from his footprints, and the noise was simultaneous with the scattering of the sand; the cause being either the accumulated vibrations of the air when struck by the driven sand, or the accumulated sounds occasioned by the mutual impact of the particles of the sand against each other. If a musket-ball passing through the air emits a whistling note, each individual particle of sand must do the same, however faint be the note which it yields; and the accumulation of these infinitesimal vibrations must constitute an audible sound, varying with the number and velocity of the moving particles. In like manner, if two plates of silex or quartz, which are but crystals of sand, give out a musical sound when mutually struck, the impact or collision of two minute crystals or particles of sand does the same, in however inferior a degree; and the union of all these sounds, though singly imperceptible, may constitute the musical note of "the Mountain of the Bell" in Arabia Petræa, or the lesser sounds of the trodden sea-beach of Eigg.

Sir A. Smith distinctly heard sounds issuing from the celebrated granite statue of Memnon, in the morning, which sounds are ascribed by others to the same cause as the sound in granite rocks. M. Salverte regards them as wholly artificial, and the work of Egyptian priestcraft; and he contrived a complicated apparatus of lenses, levers, and hammers, by which he supposed that the rays of the sun, as the prime mover, produced the marvellous sounds.

The cut on the preceding page shows the colossal statues of Memnon in the plain on the west bank of the Nile, to the northernmost of which this property has been attributed.

The speaking heads of the ancients were constructed for the purpose of representing the gods, or of uttering oracular responses. The speaking head of Orpheus, at Lesbos, is one of the most famous, and had the credit of predicting, in the equivocal language of the heathen oracles, the bloody death which terminated the expedition of Cyrus the Great into Scythia. Odin, who imported into Scandinavia the magical arts of the East, possessed a speaking head, said to be that of the sage Minos, which uttered responses. The celebrated mechanic, Gerbert, who filled the papal chair as Sylvester II. (A.D. 1000) constructed a speaking head of brass. Albertus Magnus is said to have executed a head in the thirteenth century, which not only moved, but spoke. It was made of earthenware; and Thomas Aquinas is said to have been so terrified when he saw it, that he broke it in pieces, upon which the mechanist exclaimed, "There goes the labour of thirty years!" In these cases it is probable that the sound was conveyed by pipes from a person in another apartment to the mouth of the figure. Lucian, indeed, expressly informs us that the impostor Alexander made his statue of Esculapius speak by the transmission of a voice from behind, through the gullet of a crane, to the mouth of the figure; and this method was probably general, for we read that in the twelfth century, when Bishop Theophilus broke to pieces the statues at Alexandria, he found some which were hollow, and which were so placed against a wall that the priest could conceal himself behind them, and address the ignorant spectators through their mouths.

Even in modern times speaking machines have been constructed upon this principle, it being a mere head placed upon a hollow pedestal, which, in order to promote the deception, contained a pair of bellows, a sounding board, a cylinder, and pipes, supposed to represent the organs of speech. In other cases these are dispensed with, and a simple wooden head utters its sounds through a speaking trumpet. At the court of Charles II., the deception was so effectively practised by an Englishman, until a popish priest was discovered by one of the pages in an adjoining apartment. The question had been proposed to the wooden figure by whispering into its ear, and the answers were correctly given by speaking through a pipe in the same language in which the questions were proposed. Professor Beckmann was allowed, on the promise of secrecy, to witness the process of deception. He saw the assistant in another room, standing before the pipe with a card in his hand, upon which the signs agreed upon had been marked; and he had been introduced so privately into the house, that even the landlady was ignorant of his being there.

To this class of wonders belongs the famous "Ear of Dionysius," which has often been unmasked by travellers; but Mr. Edward Postlethwaite, in his "Letters from Greece," has added some curious details. He describes the "ear" as a large black opening in a rock, in the form of the ear of an ass, and fifty feet in height. It led into a cavern sixty or seventy yards long, by five or six wide, cut by pure chiselling in the solid rock, the sides slanting towards each other as they rose, till at the top they terminated in a mere rib or riband, which indicated the winding of the den. This was in imitation of the *meatus auditorius* of a donkey, as the entrance of the ear itself was formed to catch sound and carry it to the brain. The cavern was, in short, in close proximity to the palace of

the tyrant Dionysius, of Syracuse, and from his palace was a passage to the top of the cavern. In this he shut up his suspected or disaffected subjects, and when it pleased his fancy he repaired through the passage to that part of the cavern, it is presumed, where the donkey's brain would be; and there, with his ear to the ground, he listened to the conversations, or soliloquies, or ejaculations, or even sighs, of his ill-fated prisoners. But how could he hear the latter at sixty or eighty feet off? The donkey will tell you as soon as asked. Mr. Postlethwaite's guide went to a certain part of the cave, and in a low, civil tone addressed some words of reproach to the eavesdropping tyrant overhead; and Mr. Postlethwaite was astonished at hearing his speech strike against the roof almost like a ball from a racket, louder, indeed, it seemed than when it passed his lips.

Captain Smythe, in his memoir descriptive of Sicily, gives this more scientific explanation: "It is in the shape of a parabolic curve ending in an elliptical arch, with sides parallel to its axis, perfectly smooth and covered with a slight stalactitic incrustation, that renders its repercussion exceedingly sonorous." Although a considerable portion of it has been filled up, which Captain Smythe ascertained by excavation, it is still 64 feet high, from 17 to 35 in breadth, and 187 deep, and it has an awful and gloomy appearance.

Dionysius could not, however, have listened with satisfaction or advantage, for if two or more persons are speaking together, it occasions only a continued clamour.

SOMNAMBULISM.

THE following, which was quoted some years back in *Blackwood's Magazine* as "the most interesting case of somnambulism on record," is given under the head of "somnambulism" in the French "Encyclopædia," and appears there as a narrative communicated immediately by an archbishop of Bordeaux.

At the same seminary with the archbishop was a young ecclesiastic, who used to rise every night in his sleep, and write out either sermons or pieces of music. In order to study his condition, the archbishop betook himself several nights to the chamber of the young man, where he made the following observations:—He used to rise, to take paper, and to write. Before he wrote music, he would take a stick, and rule the lines with it. He wrote the notes, together with the words corresponding to them, with perfect correctness, or, when he had written the words too wide, he altered them. The notes that were to be black he filled in after he had completed the whole. After finishing a sermon, he read it aloud from beginning to end. If any passage displeased him, he erased it, and wrote the amended passage correctly over the other. On one occasion he had to substitute the word *adorable* into *divin*, but he did not omit to alter the preceding *ce* into *cet* by adding the letter *t* with exact precision to the word first written. To ascertain whether he used his eyes, the archbishop interposed a sheet of pasteboard between the writing and his face. He took not the least notice, but went on writing as before. The limitation of his perceptions to what he was thinking about was very curious. A bit of aniseed cake that he had sought for he ate approvingly; but when, on another occasion, a piece of the same cake was put into his mouth, he spat it out without observation. The following instance of the dependence of his perceptions upon, or rather their subordination to, his preconceived ideas, is truly wonderful. It is observed that he always knew when his pen had ink in it. Likewise, if they adroitly changed his papers when he was writing, he knew if the sheet substituted was of different size from the former, and in that case he appeared embarrassed; but if the fresh sheet of paper which was substituted for that written on was exactly of the same size with the former, he appeared not to be aware of the change. And he could continue to read off his composition from the blank sheet of paper as fluently as when the manuscript itself lay before him—nay, more, he would continue his corrections, and introduce the amended passages, writing upon exactly the place on the blank sheet which would have been occupied in the written page.

Curious Plants.

A DEADLY PLANT.—A few years ago there was, in the Royal Botanic Gardens at Kew, a specimen of probably the most poisonous plant ever introduced into England. It was the *jatropha urens*, the properties of which are so noxious that its possession is positively dangerous. Mr. Smith, the curator of the gardens, was one day reaching over it, when its fine bristly stings touched his wrist. The first sensation was a numbness and swelling of the lips; the action of the poison was on the heart, circulation was stopped, and Mr. Smith soon fell unconscious, the last thing he remembered being cries of "Run for the doctor!" Either the doctor was skilful, or the dose of poison injected not quite, though nearly, enough; but afterwards the man in whose house the plant was placed, got it thrust into a corner, and would not come within arm's length of it; he watered the diabolical plant with a pot having an extremely long spout. In a short time, however, the plant disappeared altogether, and another specimen of the genus *jatropha*, which was afterwards introduced, vanished in the like mysterious manner. It was presumed that the attendants were secretly determined that such plants should not be retained

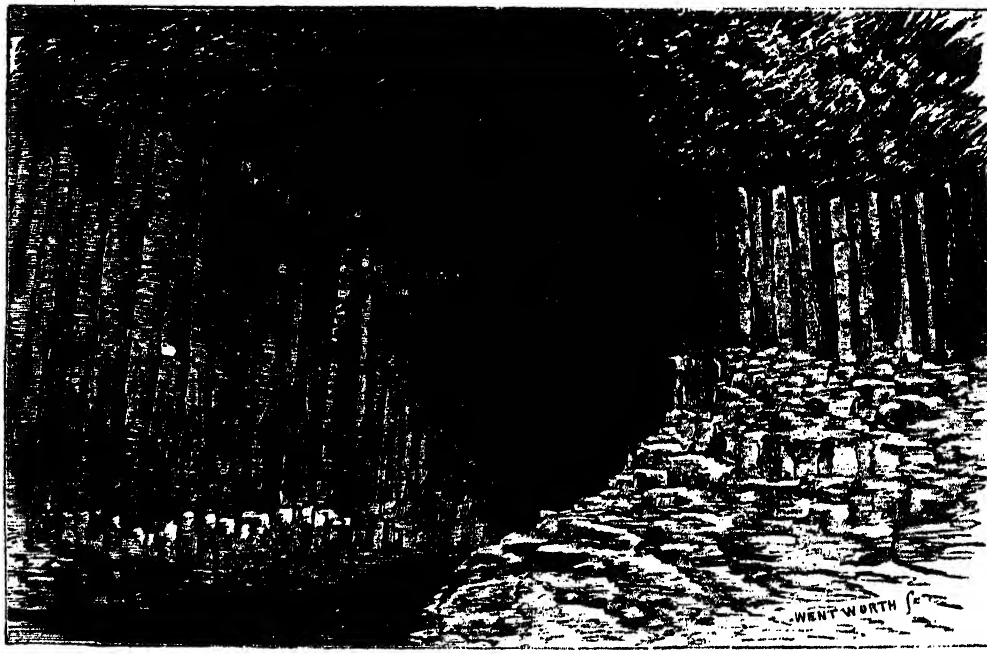
in the houses, to cause the possibility of an accident such as that which had happened to the curator.

THE HUNGER-PLANT.—In Peru a plant named the *Erythoxyolon Coca* has been found to possess the remarkable property of quelling the sensations of hunger and thirst for several days. M. de Rossi reports the fact from experiments on himself. A decoction of one hundred grains of the plant produced the effect for forty-eight hours, the muscular power being preserved. The plant appears to narcotise the nerves of the stomach, and suspend the digestive functions, without affording any nutriment.

THE FIRST MARINE CHRONOMETER.

TO ascertain longitude by means of the watch, a navigator must have a chronometer showing him the exact time at Greenwich; the instant that the sun comes to the meridian it is twelve o'clock, and the difference between this time and the hour marked by the chronometer gives him his longitude. Or, when the time is known at which any particular star passes the meridian at Greenwich, if the navigator marks the instant at which the star comes to the meridian, the difference between this time and the time it would appear at Greenwich is the difference in longitude.

This problem had been for a long time but inaccurately solved for want of good watches. Maritime nations had promised rewards to any one who should make the discovery. In 1598, Philip III. of Spain offered a prize of 1,000 crowns; the Dutch followed this example; the Duke of Orleans, Regent of France, offered in the name of the king 100,000 livres; and the French Academy awarded annually a prize to those who made the more useful discoveries connected with the subject. In 1714, Parliament appointed a committee to consider the question, foremost of whom was Sir Isaac Newton, who at once suggested the discovery of the longitude by the dial of an accurate time-keeper; and upon their recommendation the legislature of Queen Anne passed an Act granting £10,000 if the method found discovered the longitude to a degree, or sixty geographical miles, £15,000 if to forty miles, and £20,000 if to thirty miles; to be determined by a voyage from a port in Great Britain to any port in America. For nearly a century and a half philosophers alike failed, when the great discovery was made by a self-taught genius, who was bred a village carpenter: this was John Harrison, born at Faulby, near Pontefract, in 1693. He early manifested a taste for mathematical science and mechanical pursuits; and he had before made two wooden clocks, without having received any instruction in the art. He lived in view of the sea, and this led him to attempt to make a marine timepiece, and in 1736 he completed *the first chronometer used at sea*, which neither varied from change of temperature or the motion of the vessel; and this being placed on board a ship of war going to Lisbon, the captain attested that Harrison had corrected an error of about a degree and a half upon their return to the English Channel. Harrison now received from Parliament £500, to enable him to proceed with his experiments. In 1739 he produced a smaller chronometer, which promised the longitude with even greater accuracy. In 1741 he finished another, smaller than either, and the society's gold medal was awarded him. Of the third chronometer Harrison claimed a trial, and in 1761 his son William was sent out in a king's ship to Jamaica. After eighteen days' navigation the vessel was supposed to be 13° 50′ west of Portsmouth, while the watch, marking 15° 19′, was condemned as useless. Harrison, however, maintained that if Portland Island were correctly marked on the chart, it would be seen on the following day; and the captain continuing in the same course, the island was discovered next day. In like manner, Harrison was enabled by his watch to announce all the islands in the order in which they would fall in with them. On his arrival at Port Royal, after 81 days' voyage, the chronometer was about five seconds slow, and on his return to Portsmouth after a voyage of five months, it had kept time within about one minute five seconds, which gives an error of about eighteen miles. This was much within the thirty miles prescribed by the Act of 1714, and Harrison claimed the reward. Objection was, however, taken to the proof, and Harrison made a second voyage, when his chronometer determined the position of Barbadoes within the limit of the Act; £20,000 was then awarded to him, £10,000 immediately on his explaining the principle of construction, and the other half on its being ascertained that the chronometer could be made by others. The most important of Harrison's improvements are the gridiron pendulum, and the expansion balance-wheel, the one serving to equalise the movements of a clock, and the other those of a watch, under all changes of temperature, and both depending on the unequal stretching under change of temperature of two different metals, which are so employed to form the rod of the pendulum and the circumference of the wheel, that the contraction of the one exactly counterbalances the expansion of the other. The complexity of Harrison's time-keeper, and its high price, £400, left to be invented for practical purposes an instrument of greater simplicity in the time-keeper of John Arnold, for which he and his son received the Government reward of £3,000. In this machine each part performs unchecked the office assigned to it; and its extreme variation in twelve months has been 57 hundredths only. Yet, the advance in making chronometers since Harrison's time has been very great.



FINGAL'S CAVE.

FINGAL'S CAVE.

ABOUT eight miles distant from the western coast of Mull, and belonging to the Hebrides group, is the small and uninhabited island of Staffa. That it owes its existence to volcanic agency is evident from its composition, which is almost entirely lava and basalt, the columns of the latter substance being the principal formation of the island, and from which indeed it derives its name, Staffa being the Norse term for staves or columns. Numerous caverns are to be found in it, but the most celebrated of all, and to which the island owes its fame, is Fingal's Cave, or as it is sometimes called in Gaelic, Uamh an Binn—the Cave of Music, from a supposed hole in the rock, through which the water flows in and out with an harmonious sound. It lies on the southern side of the island, and it extends inwards in a N.N.E. direction for about 230 feet. Just before the entrance, on the right or eastern side especially, the columns are broken and irregular, as if the waves had worn away their shafts and left the bases only; but the entrance itself is through an archway fifty feet wide, and about seventy feet high, surmounted by an architrave of another thirty feet, and which is supported on each side for the whole length of the cave by basaltic pillars of a greenish-black hue, wonderfully jointed, and of great symmetry and regularity. The pillars vary very much in the number of their sides, though the greater part of them have five or six. The roof is almost unbroken in its surface, and is composed here and there of smooth rock, and of the cornices, as it were, of columns broken away—sometimes singly, sometimes in clusters or bunches, from which hang stalactites, white, crimson, and yellow. A yellowish-white substance resembling lime has gradually oozed out of the joints of the pillars, filling up the spaces between' and defining sharply their angles, the whole forming a species of mosaic work. The pillars on the west side are about thirty-six feet high, rising up straight from the water—while those of the east are, by the raising of their bases eighteen feet, reduced to half the height, the elevation of the roof being the same on both sides. On the eastern side is a ledge—it can hardly be called a gallery—by means of which it is possible to reach the extremity of the cave, which is there twenty feet wide. Though the floor is the sea, and the depth of water at the mouth is eighteen feet, and at the other end nine feet, it is seldom prudent and often impossible for boats to enter. The entrance being so wide, the tide makes its way in in an almost unbroken swell. Standing, however, on the ledge of rock already mentioned, it is a sight exquisitely beautiful to watch when the sun is shining, the light green waves rolling in with a loud boom, made louder by the echoes, scattering the spray to the roof, and washing the half-broken pillars on both sides, when they reach the wall of rock that bars their further progress, and contrasting their colour with the dark red or violet rocks that form

their bed, and the black columns of the walls varied here and there by the stains of lichens into bright green and red, orange, and yellow.

Curiosities of Steam Power.

THE STEAM-ENGINE AND THE HUMAN BODY COMPARED.

WE find in Dr. Arnott's practical "Treatise on Warmth and Ventilation," the following ingenious comparison :—

James Watt, when devising his first engine, knew well that the rapid combination of the oxygen of atmospheric air with the combustible fuel in the furnace produced the heat and the force of the engine; but he did not know that in the living body there is going on, only more slowly, a similar combination of the oxygen of the air with the like combustible matter in the food, as this circulates after digestion in the form of blood through the lungs, which combination produces the warmth and force of the living animal. The chief resemblances of the two objects are exhibited strikingly in the following table of comparison, where in two adjoining columns are set forth nearly the same things and actions, with difference in the names :—

TABLE OF COMPARISON.

The Steam-engine in action takes:	*The Animal Body in Life takes:*
1. Fuel—viz., coal and wood, both being old or dry vegetable matter, and both combustible.	1. Food—viz., recent or fresh vegetable matter and flesh, both being of kindred composition and both combustible.
2. Water.	2. Drink (essentially water).
3. Air.	3. Breath (common air).
And produces:	*And produces:*
4. Steady boiling heat of 212 degrees by quick combustion.	4. Steady animal heat of 98 degrees by slow combustion.
5. Smoke from the chimney, or air loaded with carbonic acid and vapour.	5. Foul breath from the windpipe, or air loaded with carbonic acid and vapour
6. Ashes, part of the fuel which does not burn.	6. Animal refuse, part of the food which does not burn.
7. Motive force, of simple alternate push and pull in the piston, which, acting through levers, joints, bands, &c., does work of endless variety.	7. Motive force, of simple alternate contraction and relaxation in the muscles, which, acting through the levers, joints, tendons, &c., of the limbs, does work of endless variety.
8. A deficiency of fuel, water, or air first disturbs and then stops the motion.	8. A deficiency of food, drink, or breath first disturbs and then stops the motion and the life.
9. Local damage from violence in a machine is repaired by the maker.	9. Local hurt or disease in a living body is repaired or cured by the action of internal vital powers.

Such are the surprising resemblances between an inanimate machine, the device of human ingenuity executed by human hands, and the living body itself—yea, the bodies of the men whose minds contrive and whose fingers make such machines. A prodigious difference, however, between the two is pointed out by the expression *vital powers*, contained in the last line of the preceding table. That difference, described in a few words, is, that while the machine has to be originally constructed, and afterwards worked and repaired and supplied with every necessary by intelligence and forces altogether external to it, the animal body performs all the offices mentioned, and others yet more surprising, for itself, by virtue of forces or powers originally placed within it by the divine Author of Nature.

GLASS-BLOWING EXTRAORDINARY.—The following curious anecdote is related by the German traveller Kohl, in his work on "Russia." The Emperor Nicholas wished to illuminate the Alexander column in a grand style. The size of the round lamps to be used for the purpose was indicated, and the glasses bespoken at the manufactory, where the workmen exerted themselves in vain, and almost blew the wind out of their bodies in the endeavour to obtain the desired magnitude. The commission must be executed—that was self-evident; but how? A great premium was offered to whoever should solve this problem. Again the human bellows toiled and puffed. Their object seemed unattainable; when at last a long-bearded Russian stepped forward, and declared that he could do it—he had strong and sound lungs, he would only rinse his mouth first with a little water to refresh them. He applied his mouth to the pipe, and puffed to such purpose that the vitreous ball swelled and puffed nearly to the required dimensions, up to them, beyond them. "Hold! hold!" cried the lookers-on, "you are doing too much; and how did you do it at all?" "The matter is simple enough," answered the long beard; "but, first, where is my premium?" And when he had clutched the promised bounty, he explained. He had retained some of the water in his mouth, which had passed thence into the glowing ball, and there becoming steam had rendered him this good service.

Wonders of Animal Life.

A LAKE OF ALLIGATORS.

ABOUT eight miles from Kurrachee, in Scinde (says the author of "Dry Leaves from Young Egypt"), is a place well worth inspecting to all who are fond of the monstrous and grotesque. A moderate ride through a sandy and sterile tract, varied with a few patches of jungle, brings one to a grove of tamarind trees, hid in the bosom of which lie the grisly brood of monsters. Little would one ignorant of the locale suspect that under that green wood, in that tiny pool, which an active leaper could half spring across, such hideous denizens are concealed. "Here is the pool," I said to my guide rather contemptuously, "but where are the alligators?" At the same time I was stalking on very boldly, with

head erect, and rather inclined to flout the whole affair. A sudden hoarse roar or bark, however, under my very feet, made me execute a pirouette in the air with extraordinary adroitness. I had almost stepped on a young crocodilian imp, about three feet long, whose bite, small as he was, would have been the reverse of pleasant. Presently the genius of the place made his appearance in the shape of a wizard-looking old Fakir, who, on my presenting him with a couple of rupees, produced his wand—in other words, a long pole—and then proceeded to "call up his spirits." On his shouting "Ao! ao!" (come, come) two or three times, the water suddenly became alive with monsters. At least threescore huge alligators, some of fifteen feet in length, made their appearance, and came thronging to the shore. The whole scene reminded me of fairy tales. The solitary wood; the pool with its strange inmates; the Fakir's lonely hut on the hill side; the Fakir himself, tall, swart, and gaunt; the robber-looking Beloochee by my side, made up a fantastic picture. Strange, too, the control our showman displayed over his "lions." On his motioning with the pole they stopped, and, on his calling out "Baitho" (sit down), they lay flat on their stomachs, grinning horrible obedience with their open and expectant jaws. Some large pieces of flesh were thrown to them, to get which they struggled, writhed, and fought, and tore the flesh into shreds. I was amused with the respect the smaller ones showed to their overgrown seniors. One fellow, about ten feet long, was walking up to the feeding ground from the water when he caught a glimpse of another much larger just behind him. It was odd to see the frightened look with which he sidled out of the way, evidently expecting to lose half a yard of his tail before he could effect his retreat. At a short distance, perhaps half a mile, from the first pool, I was shown another, in which the water was as warm as one could bear it for complete immersion, yet even here I saw some small alligators. The Fakir told me these brutes were very numerous in the river about fifteen or twenty miles to the west. The monarch of the place, an enormous alligator, to which the Fakir had given the name of "Mor Sahib" ("My Lord Mor"), never obeyed the call to come out. As I walked round the pool I was shown where he lay, with his head above water, immovable as a log, for which I should have mistaken him but for his small savage eyes, which glittered so that they seemed to emit sparks. The Fakir said he was very fierce and dangerous, and at least twenty feet in length.

FECUNDITY OF RABBITS.

THE people of Australia are becoming greatly embarrassed and distressed by the rapid increase in the number of the rabbits, which were in the first instance introduced from England. Our readers are no doubt aware that many attempts have been made in that colony, as well as in New Zealand and Tasmania, to acclimatise some of the most useful and pleasing of the fishes, birds, and quadrupeds of Europe, and these attempts have frequently been attended with great success. But the introduction of rabbits, which were among the number, has, it appears, been a great deal *too* successful. The fecundity of these animals is well known, and is a source of great annoyance and loss to the farmers in our own land, whose crops they ravage immensely. It is found in some places quite impossible to keep them sufficiently down, whether by shooting, by trapping, by smoking them out of their holes, or by the use of ferrets.

In spite of all measures taken against them, they increase and multiply fast. At the age of a few months they begin to breed, and one female will produce several litters in a single year, each litter containing from three to a dozen young ones. The colonists are beginning now to find out that, although rabbits are very good in pies and stews, and although it is also a very amusing sport to shoot them, they had, perhaps, much better have been without them altogether. We find one paper (the *Melbourne Argus*) lamenting that "it is beginning to be feared the colony has lost more than it has gained by their introduction. Complaints against their depredations are heard from all quarters. In the country to the west of Geelong, in the neighbourhood of Colac, and in the Western District, the engrossing topic of conversation is the best means for their extermination. Their numbers are so great, and to such an extent are they eating down the grass, that one large proprietor has entered upon a war of extermination, and has employed eighty-five men to starve them out by stopping up all the rabbit-holes and outlets. It is calculated that the cost of this one raid will be at least £3,000 or £4,000. In some places dogs, traps, snares, guns, and smothering, have all been tried, and many hundreds of thousands destroyed; notwithstanding which, the rabbits apparently hold their own; and it is estimated that this work of extermination will take years to accomplish."

ANTIQUITY OF NURSERY RHYMES.

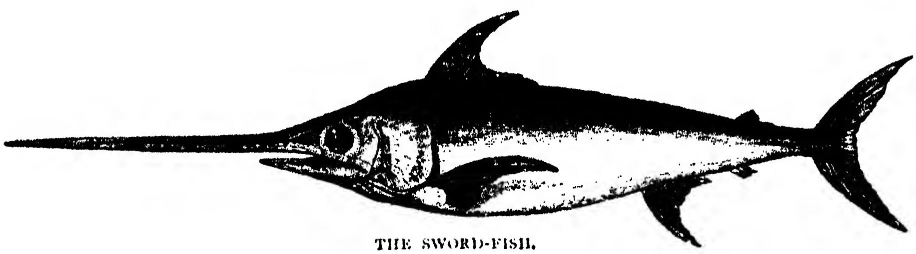
MANY of these productions have a very curious history, if it could only be traced. Some of them probably owe their origin to names distinguished in our literature; as Oliver Goldsmith, for instance, is believed in his earlier days to have written such compositions. Dr. E. F. Rimbault gives us the following particulars as to some well-known favourites:—"Sing a Song of Sixpence" is as old as the sixteenth century. "Three Blind Mice" is found in a music-book dated 1609. "The Frog and the Mouse" was licensed in 1580. "Three

Children Sliding on the Ice" dates from 1633. "London Bridge is Broken Down" is of unfathomed antiquity. "Girls and Boys come out to Play" is certainly as old as the reign of Charles II.; as is also "Lucy Locket lost her Pocket," to the tune of which the American song of "Yankee Doodle" was written. "Pussy Cat, Pussy Cat, where have you been?" is of the age of Queen Bess. "Little Jack Horner" is older than the seventeenth century. "The Old Woman Tossed in a Blanket" is of the reign of James II., to which monarch it is supposed to allude.

THE SWORD-FISH.

THE sword-fish, of which an engraving is annexed, is of the large family of the mackerel, and, like the rest of his tribe, is extremely greedy and pugnacious. For fighting he is equipped by nature with a remarkable prolongation of the upper jaw into a long sword-like weapon, from which he derives his title. The sword is rapier-shaped, and consists of a substance as dense as any known bone, covered with a substance still harder, like the enamel of a tooth. Armed with this formidable weapon, the sword-fish will attack other fishes for the sake of their bodies, which he eats with great greediness. He will sometimes run full tilt at a ship—whether under the idea that it is an edible friend, or whether, as Cuvier seems to think, out of irritation caused by a parasitic crustacean which buries itself in its flesh and causes great torment, it were difficult to say. Certain it is that, under the influence of the parasite, the sword-fish, maddened by pain, will run itself aground, apparently in hope of getting rid of its foe. The fish is a large one, attaining a length of fifteen, and even twenty feet. It is found in the Mediterranean, and in tropical seas; small specimens are also occasionally taken in British waters.

Wonderful stories have been related of its assaults on ships at sea. Some of them are no doubt exaggerated, some may be even apocryphal; but, allowing for these, there is abundant testimony to prove the wonderful character of this warrior fish. A few years since, Her Majesty's ship *Fawn*, being worn out, was in the ship-breaker's hands, and it was found, on coming to her lower timbers, that a sword-fish had pierced them to a depth of eighteen inches. The sword, having snapped off, was left in the ship's side. Nothing was known of the wound by those who had sailed in the *Fawn*. The timber, with the sword in it, is preserved in the museum of the College of Surgeons, whence it was recently taken to be exhibited in court upon the trial of an action on a policy of marine insurance, in which the plaintiff showed that certain damage done to his ship, insured by the defendants, had been the work of a sword-fish's beak. It appeared at the trial that between four and five o'clock on the afternoon of the 13th of March, 1864, the barque *Dreadnought* being on her way from Colombo to England, a sword-fish was hooked but got away, carrying with it a shark-hook and tackle. Soon afterwards the barque began to leak. She returned to Colombo, and went thence, still leaking, to Cochin. There she was hove down and examined, and after



THE SWORD-FISH.

much time had been spent in searching, a hole was discovered, about an inch in diameter, through the garboard streak on the port side. The hole was quite large enough to account for the leakage which had taken place, and the shipowner and the crew of the *Dreadnought* believed that it had been made by the sword-fish hooked, but not captured, on the 13th of March.

Professor Owen and Mr. Buckland were examined with a view to eliciting their opinion whether a sword-fish was capable of inflicting the damage deposed to. Much curious evidence was given by them as to the great power and strength of the fish; and though they said that it was not unusual for sword-fishes to attack vessels and to bury their blades in the timbers, it was not within scientific experience that the blades had ever been withdrawn. They had been snapped off, as in the case of the *Fawn*, but had not been recovered by the fish. Still, considering that the hole made in the *Dreadnought's* side was only three inches deep, the witnesses would not say the assailant might not have tugged his sword away, and so caused the leak. The jury thought he had, and the under-writers, against whom a verdict was given, were left to seek their own remedy against the perpetrator of the damage.

CORAL FORMATIONS.

THE coral animals, wonderful in themselves, are still more wonderful in their works. Out of the mouths of babes and sucklings praise is perfected, and the Almighty Creator of the universe has chosen the small creatures of his world to discharge some of the most wonderful offices in it. To the coral animals has been committed the execution of building works, far exceeding in magnitude anything that man can boast, and there is evidence that since the world began, or at all events since a very early period of its history, these tiny things, low down in the scale of life, have been the architects and builders of no small portion of the dry land which appears. Geology marks them for her own, and reveals among her treasures enormous masses of the fabric these things made before man had any being. Their historical work is done, however, and it is by their operations in the living present that we are now to judge of the importance of their position in the economy of nature.

Coral-work is of four kinds, which are known as atolls or lagoon islands, encircling reefs, barrier reefs, and coral fringes. Atolls are rings of coral enclosing a portion of the sea, but having generally on the leeward side an opening by which communication is kept up with the open water. They are not always round, some of them being of most irregular shape externally, but they are all so many enclosures presenting a barrier to the sea, which is allowed to come as far as to their sides and no farther. These sides are commonly raised from three to twelve feet above the water, and have a breadth of from a few yards to half a mile. The size of the islands varies very much, some of them being so small as scarcely to be noticed but for the surf which breaks and roars upon their rough outer walls, others having dimensions as great as eighty eight miles by twenty miles, the dimensions of the largest known lagoon in the Maldive Archipelago. Let the sea be never so rough outside the lagoon, inside the water is calm and placid, so that where an entrance is practicable, as in almost all the larger atolls, these lagoons afford a covert from the wind and a hiding-place from the tempest to ships in distress. It is uncommon not to find easy and safe anchorage inside a lagoon; though the water outside of it be bottomless to the sounding line, very often there is bottom on the inside at twenty fathoms. On the outer side of the embracing wall of the harbour of refuge, the coral shelves down gradually to say twenty five fathoms, a depth which may be obtained at a distance of two hundred yards from the island, but beyond this sounding the plummet will go into fathomless depths. At only one hundred yards away soundings have been taken to a depth of a mile and a half, and no bottom found; while inside the lagoon there has been bottom at twenty fathoms. To these islands come the waifs and strays of wind and sea, drift, weeds, plants, and seeds. These last, which are borne from very considerable distances by winds and currents, take root and bring forth fruit after their kind; wandering birds come, and their refuse and the dead leaves of plants form the beginning of a soil which is continually being formed by the attrition of water on the coral, causing a disintegration of the sun-dried mass. Thus in a marvellously short space of time is the birth of the ocean clothed and ornamented with the luxuriant vegetation of the tropics. It is a remarkable fact that the atoll-

A LAGOON ISLAND IN TH

wall is strongest on the side most exposed to the weather. The coral animals flourish best on the least sheltered side. There they get fresher and larger supplies of material, and rough usage seems only to act as a tonic, and to spur them on to greater exertion. Inside the lagoon they languish, do not work so hard, and become delicate as compared with their brethren who love to battle with the waves, and who draw fresh life out of the means of apparent destruction. Atolls are not found in the West Indian seas, where other formations of coral are abundant; but they are in countless numbers in the Pacific and Indian Oceans, where they form a principal difficulty of navigation. Their proximity is as often apprehended by the sense of sound as of sight, for the roar of the surf beating upon their sides may be heard for many miles, and will warn the sailor of his danger long before the eye can discern it. At one time it was said that these circular reefs marked the outline of a submarine crater; but this supposition is combated not only by the great extent of the diameters of the atolls, but also by their shallowness. There are few of them, as we have seen, which may not be sounded inside, and some of them have even been known to get filled up. According to Mr. Darwin, the following is the process of formation:—"An island mountain, closely encircled by a coral reef, subsides, while the fringing reef that had sunk with it is constantly recovering its level, owing to the tendency of the coral animals to regain the surface by renewed perpendicular structures. These constitute first a reef, encircling the island at a distance, and subsequently, when the enclosed island has wholly subsided, an atoll." It is now thought that atolls mark the configuration of the land as it is under water, and that they choose the loftiest heads of submarine ranges as those most worthy of being ornamented with their beautiful crown.

Barrier reefs are the work of coral animals which begin their operations upon the slope of some shelving coast, and build up gradually till they reach the surface of the water. At the surface the animals die, killed by contact with the air and sun. Between the reef and the mainland fresh-water streams empty themselves into the sea, bringing with them a quantity of land-mud, which is fatal—so is fresh water—to the existence of the *corallium*. The consequence is, that the watery gulf between the reef and the main never gets built upon by the coral contractors, who extend their operations, if at all, seawards, adding continually to the strength of their work, and increasing its area. Should the causes which retard these creatures' operations be removed, as by the drying up of some noxious river, or its diversion from its course, the busy *travailleurs de la mer* will forthwith begin to build between the land and their works. Some barrier reefs are of enormous extent. There is one on the north-east coast of Australia which is a thousand miles long, and is continuous for three hundred and fifty miles without a break or opening. It runs parallel to the land, which is, in consequence, most difficult of access.

Encircling reefs are similar in character to lagoon islands, but instead of being independent, as lagoons are, they attach themselves to some subsiding island or continent, round which they throw their arms. They will, unless means be taken to keep the navigation open, gradually cut off the object they embrace from all communication with the sea.

Fringing reefs are strips or bands of coral bound round the shore of some steep island. Where the sides of the island slope abruptly, the reefs are only a few yards wide; where they slope more gently the reefs will stretch farther—indeed, until the water deepens to about thirty fathoms, the greatest depth at which coral animals can live, and move, and have any being.

THE GARDEN SPIDER.

THE writer has often tested the intelligence and perseverance of the geometrical spider by the following, it must be admitted, aggravating experiment. Taking a piece of paper and rolling it between his fingers, he has thrown it into the web, taking care that it is not heavier than the weight of a fly. The spider runs along with alacrity towards his supposed prey, and soon discovering its unpalatable nature, carefully disentangles it, and drops it clear of the web to the ground by stretching out his first pair of legs, just as a human being might reach out his arm. He then returns to his place in the centre, and in a moment or so a piece of paper is thrown into another part of the web. The spider acts as before, and will do so, without much variation, a few times. The fifth or sixth time he rushes at the paper with an appearance of anger, or runs an inch or two along the strands as if enraged, and then back again; pauses a moment or so, as if to recover his equanimity, and then goes briskly to his disappointment, and again carefully disentangles the paper. All these movements, from the evident *feeling* and intelligence shown, are full of interest to the observer of nature, and they are sufficiently varied in individuals to make the experiment worth trying any number of times. Occasionally, for example, the spider, after he has been deceived a few times, will stretch out all his feet upon the strands, without moving from his place, and shake his web angrily; or he will *jerk* the paper out much as one might fillip it away from between the finger and thumb, with a decisive sharpness, very significant of passion. After awhile the spider will give up attacking his supposed prey.

Throw in a dozen, twenty, thirty bits of paper, and he will remain passive; but give up your sport and retire for five or ten minutes, and you will again find him busily at work, going from piece to piece until the entire web is set free.

BURKE AND WILLS, THE AUSTRALIAN EXPLORERS.

A BRIGHT day in Melbourne. August nearly at an end, and the first warm breeze of the season telling that the spring-time of the antipodes was at hand. An excited crowd pressing in one direction, to arrive at last in the Royal Park, where a busy scene was presented, as of some oriental caravan about to start. Horses, drays, pack-saddles, tents, goods such as might be suited for a long desert journey, and above all, standing swinging their long necks, kneeling in process of loading, or already burdened, were no less than twenty-seven camels. For this was the day of starting of the exploring expedition, whose duty was to pierce the thick veil that then covered the centre of the great continent of Australia, and to try and establish communication between Melbourne in the far south, and the land directly north upon the shores of the great Gulf of Carpentaria.

The preparations were at length made, the last farewell and "God speed you" uttered, and then the train started in quiet regular order along the beaten tracks, past station after station, where the desert had been brightened by the home of the settler, and dotted by his flocks and herds. At the close of each day a halt was made, and then at early dawn on again, till the enclosed districts were left behind; and, with the vast pathless wild before them, the magnitude of the undertaking first burst in all its reality upon the travellers. Mr. Burke was the captain of the expedition, Mr. Landells his second in command, and Mr. W. J. Wills, a promising young man of twenty-seven, the third; the party being composed of fifteen more, all told, well and liberally supplied by the Government of Victoria with provisions and instruments for observation.

So far, all had gone on in the most promising way, and by easy stages the expedition had advanced ever due north, encountering no further obstacles than the want of water, or a too great abundance in some creek or river, which rendered fording necessary. But now the foreman of the party, evidently alarmed, made objections, and behaved in a way which rendered his discharge imperative; while before much more ground had been covered there was again dissension in the camp, ending in the resignation of the second in command and the doctor.

This last was, however, evidently a gain, and, appointing Mr. Wills now his lieutenant, Mr. Burke pushed on to Cooper's Creek, a watering-place about halfway between Melbourne and the head of the gulf. Here they waited for some considerable time for the coming up of fresh stores of provisions, but at length, growing impatient at the loss of valuable time, Burke determined to push on, and after making arrangements for the establishment of a depôt of provisions, whereupon he could fall back, the leader left the bulk of his party with instructions to stay at the creek until his return, and then, in company with Wills and two men, taking with them six camels, a horse, and a supply of provisions, started forward to pursue the expedition, opening up a route to the gulf, and, in spite of some difficulties, achieving the first part of their task, having from starting made about one hundred and twenty halts at various camps on a journey which lasted till February of the following year, 1861.

On the 13th of February, having accomplished their design, Burke and Wills began the return route, rejoining their two men whom they had left with the camels at camp 119. And now began the serious part of the journey. Frequent thunderstorms and heavy rain made the ground boggy, distressing their horse and camels; the food ran short, and birds were unaccountably wild and hard to approach. The one horse they had soon became so toilworn that he was shot, and they were glad to eat his flesh. Soon after one and then another camel shared the horse's fate, the flesh being jerked for future consumption. The long, toilsome journey was telling fast upon the travellers, bad supply of food and constant exposure adding their part to make the once buoyant, gallant men weak and low-spirited. But there was now the recollection that could they reach the depôt at Cooper's Creek there would be rest, fresh horses and camels, and abundant store of provisions.

And now came a great trouble upon them—the little party of four was reduced to three by the death of Gray, one of the men, at a time when, after watching his last struggles, the survivors were so weak that they could hardly dig a shallow grave in which to cover the poor fellow's remains.

With death staring them in the face, they once more pressed on, suffering from hunger and thirst by day, and from the piercing cold by night; hardly able to keep together, and with their six camels now reduced to two; here through long flats of kangaroo grass, reaching to their shoulders, or rich spear grass, making their way more toilsome as they waded through it knee-deep; over creek and billibang; across vast sandy plains; by gum tree and salt bush; ever on and on for the haven of rest that it seemed they would never reach—despairing sometimes, hoping at others, till on Sunday, April 21st, the little wayworn party reached the creek, to stand lost, stunned, stupefied with amaze-

ment and the great despair that filled their souls, as, after their long and frightful journey—pioneers of civilisation that they were—after some 1,500 toilsome miles of desert, they found themselves starving, weak, despairing, and with their clothes falling from them in tatters, alone in the great wilderness.

Utterly prostrated, Burke threw himself upon the ground to bury his face in his hands, while, with blank despair depicted in their countenances, his companions stood amidst the awful stillness to try and not believe that the trouble could be true. But the great blank truth was before them, and, once more collecting the energy that had led him across the pathless waste from shore to shore of the vast continent, Burke arose, and after a little examination of the place, they found that at the foot of a tree a tolerably abundant store of provision had been left; but the pleasure was damped by the discovery of a letter, telling them that those left in charge of the depôt had departed with plenty of provisions, six camels, and twelve horses, all in good condition, that very day—but a few hours before the arrival of the hapless wanderers.

"Can you make an effort to overtake them?" was the leader's query to his followers; and the answer was in each case, "No." "I thought it my duty to ask you," he says, "but for my part I could not have stirred."

Nor was it likely that the three fearfully weakened men could have gone many miles in pursuit of those who, they were given to suppose, were fresh and well-mounted. The attempt seemed hopeless and absurd. Here, then, they determined to rest and recruit for awhile, trusting that the change of diet they could now enjoy would restore their strength, and enable them by a different route to reach some of the most advanced settlements of South Australia by way of Mount Hopeless.

Hopeless it proved; for after many weary attempts, checked ever by the want of water, they were glad to return once more to the depôt camp, hopeful that a party might be sent up to their rescue; but it came not. And now appeared new actors upon the scene in the shape of a tribe of natives, who, during their stay in the neighbourhood, not merely supplied them with fish, but with a bread composed of the seed known amongst them as "nardoo"—a seed obtained from a plant growing after the fashion of the clover of our fields.

The days passed on, with the hopeless travellers daily growing weaker; the last fragments of camel eaten, and an occasional crow forming their sustenance; for the natives were gone, and the stores left exhausted. After a search, King found out where the nardoo grew; but now a fresh disaster befel them—the gunyah or hut was burned, and with it clothes, coverings, and guns and instruments destroyed. But, in spite of all, Mr. Wills kept on writing his journal from day to day, in a cheerful spirit that breathes of resignation, and hardly reveals the weakness of the sufferers, till we read that from getting too feeble to go and gather the nardoo, first one and then the other grew too weak even to pound it into flour; and after having had his journal buried in the depôt caché, Mr. Wills, as a last resource, begged of his two companions to leave him, helpless and alone in the wilderness, while they went to try and bring some of the natives to his aid.

A pitiful scene! the dying man giving his wallet and a letter to his companion in the long journey, and urging him to go, until, slowly and unwillingly, with hanging head and faltering steps, Burke left him, followed by King. One day they travelled on slowly, Mr. Burke complaining of weakness. On the second day, at the end of two miles, he declared he could go no farther, and, after struggling on a little distance, he lay down calmly and resignedly, his great task done, to seek for rest. No great horror and dread of death upon him, no wild struggle of the strong against the appalling shade; but the weary wanderer putting his little affairs in order, calmly giving a few directions to his follower, ending by asking him to stay with him till he was quite dead, and then hopefully and gently sinking without a struggle into his last long sleep.

King, his humble companion, stayed by him, and in his simple homely words—words expressive of volumes when taken in connection with his position, hundreds of miles from civilised man, says, "I felt very lonely."

Almost ready to lie down by his chief, King struggled on a little farther, to find a native hut with food therein; and after a rest, the poor fellow toiled back to the gunyah where he had left Mr. Wills, to find that he had joined his brave-hearted leader, for Wills too was at rest. King says but little of his own feelings in his simple narrative, but even the savages who clustered round the bough hut, where now a few branches and some sand covered the brave young man's remains—even they could add their little to the covering of the cold clay, and weep bitterly at his fate.

Dead both, when, but for cold neglect and carelessness, the gallant fellows—men whose names will ever shine in history—might have been saved, for "they perished with help so nigh and yet so far from them." Their part of the task was nobly done, but those who should have been ready to receive them on their return cruelly abandoned them to their fate.

Too late were the failings of the expedition discovered—its badly chosen officers, and arrangements too cumbersome for such a duty; and too late was the arrival of those sent to discover the gallant men who had won a way through the pathless land.

VIEW OF THE ESCURIAL.

THE PALACE OF THE ESCURIAL.

THE famous palace and monastery of the Escurial stands in the kingdom of Toledo, seven leagues from Madrid. The term *Escurial*, or *Escorial*, is considered by some to be Arabic, meaning a place full of rocks; but by others is derived from *scoria ferri*, iron dross, from there having been anciently great iron works near this place. The Spaniards call it *la octava maravilla*, "the eighth wonder," and eccentricity of plan and vast extent entitle it to this distinction. It owes its existence to the bigotry of Philip II., who, in his fight with the French at St. Quintin, vowed that if he were successful he would build the most magnificent convent in the world, in honour of the saint whose name should be found that day upon the calendar. The battle being won, it was found that San Lorenzo, or St. Lawrence, was the lucky patron; and measures were forthwith taken for the fulfilment of the vow. According to the legend, this saint suffered death by being broiled on a gridiron; and the architect, Juan Baptista de Toledo, at once took it into his head to build the convent on that singular plan. "With this view," says the author of "A Year in Spain," "he represented the several bars by files of building, the handle by a portion of the church, and even the feet by four insignificant towers which rise at the corners. Indeed, the only poetic licence he was guilty of, was in supposing his gridiron to be turned upside down." This is confessedly the most wonderful edifice in Europe, whether in dimensions or riches. It has 1,860 rooms, 6,200 windows and doors, 80 staircases, 73 fountains, 48 wine-cellars, 8 organs, and 51 bells. It contains, also, 1,560 oil-paintings; and the frescoes, if all brought together, would form a square of 1,100 feet. Its circumference is 4,800 feet, nearly a mile.

The plan is divided so as to form a convent with cloisters; two colleges; the royal palace; three chapter-houses; three libraries, with about 30,000 volumes and some valuable MSS.; five great halls; six dormitories, thirty other halls, nine refectories, and five infirmaries, with apartments for artisans and mechanics.

The church is a wonderful structure. "The riches of Spain and her ancient colonies," says

Inglis, "are exhausted in the materials—marbles, porphyries, jaspers of infinite variety, and of the most extraordinary beauty, gold, silver, and precious stones; and the splendid effect of the whole is not lessened by a nearer inspection: there is no deception, no false glitter; all is real. The whole of the altar-piece in the Capella Mayor, upwards of ninety feet high and fifty broad, is one mass of jasper, porphyry, and marble. The church has forty chapels, each with its altar; and it is crowned with a dome 330 feet high from the ground. There is a mausoleum, encrusted with marbles; the design is in imitation of the Pantheon at Rome. The cost of the Escurial was six millions of piastres. A description of the edifice was translated into English by a servant of the Earl of Sandwich, in his embassy to Spain in 1671, from which it appears that the Escurial was reported to have been destroyed by fire in that year. There was a similar report about sixty-five years ago.

Aged and Curious Trees.

YEWS AND OAKS.

YEW TREES, of all European trees, are considered by De Candolle to attain the greatest age; and he assigns an antiquity of thirty centuries to the *Taxus baccata* of Braburn, in Kent; from twenty-five to thirty centuries to the Scotch yew of Fortingal; and fourteen and a half and twelve centuries respectively to the yews of Crowhurst, in Surrey, and Ripon (Fountains Abbey), in Yorkshire, but these ages are conjectural on the size. Beneath the three yews at Ripon, the founders of Fountains Abbey are stated to have held their rural council in A.D. 1132; they are yet standing, and Norman churches in England are found with yews beside them older than the church. A yew-tree at Aukerwyke House, near Staines, is supposed to be of great antiquity: there is a tradition that Henry VIII. occasionally met Anne Boleyn under its branches. This yew is stated to have been a vigorous tree on the bank of the Thames, opposite Runnymede, when Magna Charta was signed there in 1215; and it still bears its green leaf after 650 winters. The yew trees at Kingley Bottom, near Chichester, in Sussex, date as far back as the landing of the Sea Kings on the coast of Sussex. On one of the South Down hills, immediately above the yew tree valley, and called Bow Hill, are some tumuli, which are always called by the natives the graves of the Sea Kings, who, with their followers, are supposed to have fallen in a battle fought under these very yew trees. The celebrated yew in Harlington churchyard, Middlesex, was formerly clipped into fantastic shapes, but since 1790 has grown in its natural form; in 1823 its age was stated at 800 years; height of stem, 44 feet 6 inches: circumference of trunk, 14 feet 1 inch; spread of branches, 150 feet. Mr. Bowman, F.L.S., as the result of his observations upon the growth of several yew trees, concludes that their diameter increases during the first 120 years at the rate of one-sixth of an inch per annum. In Gresford churchyard, near Wrexham, North Wales, eighteen yew trees, recorded to have been planted in 1726, averaged twenty inches in diameter in 1836. Another yew tree in the same churchyard had a trunk twenty-two feet in circumference at the base, and twenty-nine feet below the first branches. From three sections of this tree, Mr. Bowman found the average of rings deposited for one inch in depth of its latest growth to be thirty-four and two-thirds, comparing which with the data of eighteen young trees, the probable age of this tree was 1,419 years. Another yew tree in Darley churchyard, Derbyshire, is calculated to be 2,006 years old. Norbury Park, in Surrey, has a "Druids' grove" of yews, of girth but seldom equalled; one is upwards of twenty-two feet in circumference.

Owen Glendower's Oak, at Shelton, near Shrewsbury, is named from that chieftain, who from its branches is said to have witnessed the great battle between Henry IV. and Henry Percy, July 20th, 1403. It is so hollow on the inside that six or eight persons may stand within it. Its extreme girth is 40 feet 3 inches, and it is healthy and flourishing. *Cowthorpe Oak*, near Wetherby, in Yorkshire, is stated by Professor Burnet to be 1,600 years old, and so large is its hollow as to have contained within it seventy persons at one time. The famous *Fairlop Oak*, in Hainault Forest, was 36 feet in circumference about a yard from the ground, and its shade overspread an area of 300 feet in circuit; it was blown down in 1820. The *Oak of the Partisans*, in the forest of Parey, Saint Ouen, in the department of the Vosges, extends its branches over 100 feet, and its height is 107 feet; it has lived 650 years, and was known at the time when the Cothereaux, the Carriers, and Routiers devastated France, in the days of Philip Augustus. The *Bull Oak*, Wedgenock Park, and the *Plestor Oak*, Colborne, are believed to be as old as the time of disparking lands, after the Norman Conquest; but the *Winfarthing Oak*, and the *Bentley Oak*, are believed to have been 700 years old at the time of the Conquest. *William the Conqueror's Oak*, in Windsor Great Park, measures at four feet from the ground, 38 feet in girth, and is probably from 1,000 to 1,200 years old. The great *Oak of Saintes*, in the department of Charente Inférieure, measures 23 feet in diameter five feet from the ground, and is large enough to contain a small chamber; its antiquity is conjectured at 1,800 or 2,000 years. Dr. Goddard remarks:—"It is commonly and very probably asserted that a tree gains a new ring every year." In the body of

a great oak in the New Forest, three and four hundred rings have been distinguished. The *Queen's Oak* at Huntingfield, in Suffolk, was situated in a park belonging to Lord Hunsdon, where he entertained Queen Elizabeth, who is reported to have shot a buck with her own hand from this oak. *Sir Philip Sidney's Oak*, near Penshurst, is said to have been planted at his birth in 1554. It has been celebrated by Ben Jonson and Waller. This oak is above 22 feet in girth; it is hollow and stag-headed. The *Ellerslie Oak*, near Paisley, is reported to have sheltered among its branches Sir William Wallace and 300 of his men. If this legend were true, it would imply that the tree was in its full vigour at the end of the thirteenth century. The *Swilcar Oak*, in Needwood Forest, Staffordshire, is stated by Strutt "to be known by historical documents to have been, in 1822, 600 years old." This noble tree stands on a beautiful lawn surrounded with extensive woods. It measures 13 yards round at its base. The *Abbot's Oak*, near Woburn Abbey, is stated to derive its name from the fact that the abbot of the monastery was, by order of Henry VIII., hung from its branches in 1537. Marshall says:—"If we consider the quick growth of the chestnut, compared with that of the oak, and at the same time the inferior bulk of the Tortworth chestnut to the Cowthorpe, the Bentley, and the Boddington oaks, may we not venture to infer that the existence of these truly venerable trees commenced some centuries prior to the era of Christianity?"

A WONDERFUL TIDE.

In the collection of tracts forming a portion of the library of King George III., in the British Museum, is one of four leaves, which contains the following account of an extraordinary phenomenon observed at London Bridge in the middle of the seventeenth century:—

"Friday, February 4th, 1641, it was high water at one of the clock at noon—a time, by reason so accommodated for all employments of water or land, very fit to afford witness of a strange and notorious accident. After it was full high water, and that it flowed its full time, as all almanacks set down, watermen, the unquestionable prognosticators in that affair, with confidence maintain it stood a quiet, still, dead water a full hour and a half, without moving or returning in any way never so little; yea, the watermen flung in sticks to the stream as near as they could guess, which lay in the water as upon the earth, without moving this way or that. Dishes, likewise, and wooden buckets, they set a-swimming; but it proved a stilling, for move they would not any way, by force of stream or water, so that it seemed the water was indeed asleep or dead, or had changed or borrowed the stability of the earth.

"The watermen, not content with this evidence, would needs make the utmost of the trial, that they might report with the more boldness the truth of the matter; and with more credible confidence they took their boats, and launched into the stream or very channel; but the boats that lay hauled up on the shore moved as much, except when they moved their oars; nay—a thing worthy the admiration of all men—they rowed under the very arches, took up their oars, and slept there, or, at least, lay still an hour very near; their boats not so much as moved through any way, either upward or downward, the water seeming as plain, quiet, even, and stable as a pavement under the arch, where, if anywhere in the Thames, there must be moving, by reason of the narrowness of the place.

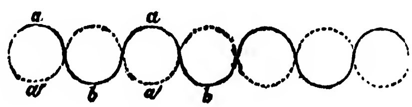
"In this posture stood the water a whole hour and a half, or rather above, by the testimony of above 500 watermen on either side of the Thames, whom not to believe in this case were stupidity, not discretion. At last, when all men expected its ebb, being filled with amazement that it stood so long as hath been delivered, behold a greater wonder—a new tide comes in! A new tide with a witness. You might easily take notice of him; so loud he roared that the noise was guessed to be about Greenwich, when it was heard so, not only clearly but fearfully to the bridge; and up he comes, tumbling, roaring, and foaming in that furious manner that it was horror unto all that beheld it. And as it gave sufficient notice to the ear of its coming, so it left sufficient satisfaction to the eye that it was now come, having raised the water four foot higher than the first tide had done—four foot by rule, as by evident measure did appear, and presently ebbed in as hasty, confused, unaccustomed manner. See here, reader! a wonder that, all things considered, the oldest man never saw or heard of the like."

THE WONDERS OF LIGHT.

What is light? The answer is wonderful enough. Light is motion—the motion or vibration of an imponderable, invisible, all-present something, which, for the want of a better word, philosophers call ether. This ether permeates all space, and is capable of receiving various kinds of motion. Sir Isaac Newton, the most profound of natural philosophers, left at the end of his great work, the "Principia," three assertions—assertions which all but deserve the name of prophecies, for he seems to have had little reason for making them beyond his marvellous sagacity. Two of these have already been found true, and the third seems daily approaching demonstration. It is, that light, heat, magnetism, electricity, and animal life are

all the offspring of one great source; or, in other words, that these wonderful powers are all allied to each other, and are probably only the same thing in different states of motion. Every year science discovers some new connecting link. We know that electricity can produce light, heat, and magnetism, and that a dead body can be made to exhibit the muscular functions of life under its influence; and that the reverse of all this is true, that electricity in its turn can be produced by heat or magnetism, or animal life. So that the day may yet come when we shall be able to show that these powers are only different states of this very ether whose motion produces light!

The eye is such a delicate organ, that we have a better means of investigating the properties of light than those of any of the kindred powers. And truly are the results of this investigation wonderful! That motion of this ether which is light, is termed "wave motion." If a stone be thrown into water, rings of waves begin to circle from the place where the water was disturbed, widening further and further. If there should be a piece of straw or any light body floating on the water, the wave does not carry this with it, but it merely rises and falls as the wave passes beneath it; teaching us that the water does not move in the direction of the wave, but each particle of fluid rises and falls again into the exact place from which it was disturbed. This is wave motion, and is the manner in which all disturbances are propagated in different media. For example: sound is produced by similar waves in the air. The air is not put into motion in such a manner as to produce wind—we do not feel a breeze, when listening to an organ, issuing from the instrument—and yet we know that sound is produced by waves of air, as we shall presently show. In an earthquake this same kind of motion is produced, and as the waves ripple the surface of the land, they upset buildings, &c.; but the earth is not cast up in waves and ridges, like huge furrows of a ploughed field, thrown in confusion over each other. A wave, in scientific language, is, therefore, understood to be an undulatory movement which passes through the medium without permanently disturbing it.



We may give some idea of the manner of this vibration which takes place in a pencil of light, by fastening a long cord to a distant point, holding the other end in the hand. When the hand is shaken, a wave runs along the string; if the hand be turned round as it is shaken, a series of waves in different positions would pass along the cord. If we imagine this cord to be ether, and, instead of one hand, many were at the same time causing the oscillations in different positions, we should have a pencil of light.

The size and rapidity of these waves can be measured. If the curved line in the figure represent a wave of ether, the colour of the light will depend on the length of the wave—that is, upon the distance from *a* to *a*. This is longest in red light, being $\frac{1}{37000}$th of an inch; if the light be violet, the length is $\frac{1}{60000}$th of an inch.

The brightness or intensity of the light will depend on the depth of the wave, or the distance from *a* to *b*. The colour is also influenced by the rapidity of vibration—that is, the number of times the point *a* will descend to *a'*, and back again in a second. It is truly a triumph of science to have measured this time of oscillation. For red light it is 482,000,000,000,000 in a second, while for violet light it is no less than 707,000,000,000,000 a second! What greater wonder can be expressed than to say that during every second the eye is looking at a violet flower or a mauve ribbon, the delicate retina is receiving and recognising 707 million millions of impulses!

Conceive the number! Suppose that there were 3,000,000 people in London capable of counting 100 every minute, that this vast multitude counted on twelve hours every day; it would take their united effort to count for nearly ten years before they told the number of the vibrations which cause us to perceive violet colour for *one second*.

Yellow is caused by a number of oscillations midway between these extremes. How little do we know how wonderfully we are made! We do not say that the retina of the eye, which is the network of the optic nerve spread out to catch the light which enters through the pupil, absolutely vibrates this enormous number of times itself, but it is so delicately constructed that it can be affected by these vibrations; and the nerve receives them, and transmits them faithfully to the brain. Many persons are colour-blind. That is on account of some defect either in the construction of the retina, or in the means of transmitting its impressions to the brain; the proper number of oscillations is not registered, and therefore the right colour is not perceived. Just so with the ear. If the tympanum, or the fine membrane which is stretched across the tube which has its opening in the ear, be thick, it is not capable of feeling very rapid vibrations of the air, which beat against it; and as the higher the note the greater are the number of vibrations—for example, the highest note in a piano causes about three thousand vibrations in a second! Many people cannot hear so high a note, because their tympanum has become thick; and many more cannot hear the chirp of a cricket, for the same reason. The delicate construction of the eye and the ear is truly wonderful.

GRACE DARLING'S [illegible] THE CREW OF THE "[illegible]."

The current was setting to the southward, in the direction of the Fairway, the dangerous channel through which the steamer had so lately passed. The shipmen were ignorant of their position until suddenly the Farne Islands light flashed upon them, and they saw close under their lee the broken water which marked the spot where outlying rocks lurked in ambush for them.

Captain Humble did his utmost to run his ship into the channel, through which he hoped he might get into clear water beyond; but she was not under command, and between three and four o'clock on the morning of the 7th September, she struck heavily forward upon a sharp rock of one of the Farne Islands. Nine of the crew lowered a boat and so saved themselves, being picked up next day by a passing ship; but no attempt was made to save any more lives. Soon after the first shock had taken place, the waves struck the steamer some heavy blows on her quarter, and then, uniting their strength, lifted her, to fling her down again on the edge of the rock. Immediately she broke her back, and the after part, containing the captain, his wife, and many of the passengers, was swept away and destroyed with its living freight. The fore part fell forward on the rock. Upon it, and in the make-shift shelter furnished by its wreckage, were clustered nine persons, five of the crew and four passengers, including a poor woman whose two children died in her arms during the night. When morning broke the look-out at the lighthouse on the Longstone, one of the Farne group, descried the position of the sufferers, and saw also the apparent impossibility of assisting them. The wind had abated a little, but the sea was still tremendously high, and around the rocky Farnes was surging and seething like the water in a mill dam. In the Longstone lighthouse were three persons, William Darling, his wife, and their daughter Grace, who was twenty-three years of age. What assistance could they render? William Darling thought none, and, knowing the great danger of the navigation at all times, but especially in stormy weather—knowing also that unusual strength would be necessary to pull a boat through such a sea as was running—determined to leave the shipwrecked folk to their fate. Men on the mainland refused that day to put off, though for substantial reward.

Grace Darling knew less, perhaps, than her father about the perils of a rescue, but she could not bear the idea of no attempt being made to save those who could be seen by the aid of a glass clinging to the wreck on the sea-washed rock about a mile away. She begged that the lighthouse boat might be launched, and declared her own readiness and ability to take an oar. Doubtingly and with misgiving, William Darling yielded to his daughter's solicitations, and, with the help of wife and maiden, got the boat into the water. Then came the difficulty, then there was the danger. Bravely, *manfully*, perseveringly the two rowers toiled at their work, now raised high on the crest of one wave, now buried in the lap of another, now using all their skill and co-operation to keep the boat's head to the breakers, now giving way with earnest will to pull the boat through them. On they went, spurred to exertion not only by the enthusiasm of humanity, but by prudential motives, for they knew that unless they could get back from the goal they aimed at with the flow of the tide, they would have to be prisoners with the shipwrecked till the tide served again. After a severe labour which well-nigh exhausted the crew, the lighthouse boat was brought alongside the rock on which the miserable people were. Well might they wonder at the sight the boat presented; well might they wonder to see in one of their rescuers a fair maiden, young and feminine in her looks, who yet seemed able to manage her oar with all the skill, strength, and dexterity of the most practised boatman.

All the survivors were taken off, and brought back to the Longstone, where they were duly cared for and entertained until, the boisterous weather having subsided, they could be fetched by succours from the mainland. Four years afterwards Grace Darling, whose wonderful courage and hardihood were thus the means of saving nine lives, fell a victim to consumption; but her name still lives, and must endure until the day when the world shall cease to admire and love those who are capable of the most exalted and wonderful heroism.

A NATURAL ÆOLIAN LYRE.

NEAR Freyberg, in the Grand Duchy of Baden, there is a chasm in a mountain, remarkable not only for the romantic nature of the scene, but for the extraordinary sounds which occasionally issue from it. This latter peculiarity was first observed at the end of the seventeenth century by some soldiers stationed on the adjoining heights, who heard melodious tones resounding from the tops of some fir-trees which grew beside a waterfall in a neighbouring wood. The current of air ascending and descending through the chasm, receives a counter impulse from an abrupt angle of rock, and acting on the tops of the trees and shrubs, forms a natural Æolian harp, the tones of which are accompanied by the gurgling of the waterfall. The religious spirit, which was the prevailing characteristic of the age, led the soldiers to regard this phenomenon as the result of supernatural agency. On approaching the spot whence the music issued, they found affixed to the tallest of the group of fir-trees a wooden image of the Virgin holding the infant Jesus in her arms. This image was erected, in 1680, by Frederick Schwab, a citizen of Freyberg,

as a memorial of his having been cured of leprosy by the water of the mountain spring. The soldiers, however, conjectured that the aërial music which had attracted them to the spot was the singing of the celestial choir. Near the image was placed a box for the reception of offerings, which soon became sufficiently numerous to defray the expense of erecting a chapel on the spot.

THE EARTH-EATERS.

To "eat dirt" is naturally, as well as metaphorically, a most disagreeable and unwholesome undertaking; but to eat dirt in the literal sense, and not only to enjoy it, but to thrive on it, is so contrary to our ordinary ideas as to seem absolutely impossible. Nevertheless, it is perfectly true that earth-eaters are to be found among the tribes of the human race; and we will give our readers an account of these people and their usages, on the authority of the famous scientific traveller, Baron von Humboldt.

In his "Aspects of Nature," it is related that in descending the Orinoco—a river which runs through Venezuela, in South America—he passed a day with the earth-eating tribe of Indians called the Otomacs. The Baron thus describes the peculiar diet and habits of this people:—

"The earth which the Otomacs eat is a soft unctuous clay, a true potter's clay, of a yellowish-grey colour, due to a little oxide of iron. They seek for it in particular spots on the banks of the Orinoco and the Meta, and select it with care. They distinguish the taste of one kind of earth from that of another, and do not consider all clays as equally agreeable to eat. They knead the earth into balls of about five or six inches diameter, which they burn or roast by a weak fire, until the outside assumes a reddish tint. The balls are remoistened when about to be eaten. It is a proverb among the most distant of the nations living on the Orinoco, when speaking of anything very unclean, to say that it is 'so dirty that the Otomacs eat it.' As long as the waters of the Orinoco and the Meta are low, these Indians live on fish and river tortoises. During the periodical swelling of the rivers the taking of fish ceases, for it is as difficult to fish in deep river water as in the deep sea. It is in this interval, which is of two or three months' duration, that the Otomacs swallow great quantities of earth. We have found considerable stores of it in their huts, the clay-balls being piled together in pyramidal heaps. A very intelligent monk, who lived twelve years among these Indians, assured us that one of them would eat from three-quarters of a pound to a pound and a quarter in a day.

"According to the accounts which the Otomacs themselves give, this earth forms their principal subsistence during the rainy season, though they eat at the same time occasionally, when they can obtain it, a lizard, a small fish, or a fern root. They have such a predilection for the clay that even in the dry season, when they can obtain plenty of fish, they eat a little earth after their meals every day as a kind of dainty. The Franciscan monk who lived among them as a missionary, assured us that he perceived no alteration in their health during the earth-eating season.

"The simple facts are therefore as follows:—The Indians eat large quantities of earth without injury to their health; and they themselves regard the earth so eaten as an alimentary substance, *i.e.*, they feel themselves satisfied by eating it, and that for a considerable time; and they attribute this to the earth or clay, and not to the other scanty articles of subsistence which they now and then obtain in addition. If you inquire from an Otomac about his winter provision, he points to the heap of clay balls stored in his hut."

Humboldt combats the idea that this clay had anything such as maize, meal, and crocodile-fat mixed with it, as some writers had asserted; and he then goes on to say; "In all tropical countries, human beings show an almost irresistible desire to swallow earth; and not alkaline earths, which they might be supposed to crave in order to neutralise acid, but unctuous and strong-smelling clays. It is often necessary to confine children to prevent them from running out to eat earth immediately after a fall of rain. I have observed with astonishment the Indian women in the village of Banco, on the Magdalena river, while engaged in shaping earthen vessels on the potter's wheel, put great lumps of clay into their mouths. With the exception of the Otomacs, individuals of all other races who indulge for any length of time the strange desire of earth-eating have their health injured by it. At the mission of San Borja we saw the child of an Indian woman, who, his mother said, would hardly eat anything but earth. He was, however, wasted nearly to a skeleton.

"In the Island of Java, Labillardière saw small square reddish-coloured cakes exposed for sale in the villages. On examination and inquiry, he found that the cakes consisted of reddish clay, and that they were eaten. The edible clay of Samarang was sent to Berlin in the year 1847, in the shape of rolled tubes like cinnamon, and was found to be a fresh-water formation deposited on limestone, and consisting of microscopic Polygastrica, &c."

Other instances are mentioned, and the Baron concludes by saying: "Thus we find the practice of eating earth diffused throughout the torrid zone, among indolent races inhabiting the finest and most fertile parts of the globe. But accounts have also come from the North, according to which hundreds of cartloads of earth containing Infusoria

are said to be annually consumed by the country people, in the most remote parts of Sweden, as bread-meal, and even more from fancy than necessity! In Finland this kind of earth is occasionally mixed with bread. It consists of empty shells of animalculæ, so small and soft that they do not crunch perceptibly between the teeth. It fills the stomach, but gives no real nourishment. In periods of war, as, for example, during the Thirty Years' War in Pomerania, in the Lausitz, and in the territory of Dessau, and subsequently in 1719 and 1733 at the fortress of Wittenberg, chronicles and documents preserved in archives often give intimation of earths containing Infusoria having been eaten, speaking of them under the vague and general name of 'mountain meal.'"

MUSICAL FISH, OR MOLLUSCA.

When Sir Emerson Tennant visited Batticaloa, in the northern forests of Ceylon, about twenty years ago, he made inquiries relative to a story which had reached him of musical sounds said to be heard issuing from the bottom of a lake, at several places, both above and below the ferry opposite the old Dutch fort. The sounds were said to be heard at night, and most distinctly when the moon was at the full. They were described to him as resembling the faint sweet notes of an Æolian harp. On conversing with the fishermen of the lake, they confirmed these statements, and expressed their belief that they proceeded from a shell known by the Tamil name of *oorie coolooroo cradoo*, or the "Crying shell." The specimens shown to him were identified as those of the *Cerithium palustre* and *Littorina lævis*.

One moonlight evening, when not a breath of air was stirring, and not a ripple was to be seen on the water except that caused by the dip of their oars, Sir Emerson Tennant accompanied the fishermen to the spot. On arriving at the point mentioned, he avers that he distinctly heard the sounds rising up from the lake, like the gentle thrills of a musical chord, or the faint vibrations of a wine-glass when its rim is rubbed by a wet finger. He says: "It was not one sustained note, but a multitude of tiny sounds, each clear and distinct in itself; the sweetest treble mingling with the lowest bass. On applying the ear to the woodwork of the boat, the vibration was greatly increased in volume by conduction. The sounds varied considerably at different points as we moved across the lake, as if the number of the animals from which they proceeded was greatest in particular spots; and occasionally we rowed out of hearing of them altogether, until, on returning to the original locality, the sounds were at once renewed."

Sir Emerson Tennant was induced to conclude from all the facts, that the sounds were really produced by shell-fish. "They came evidently and sensibly from the depth of the lake, and there was nothing in the surrounding circumstances to support a conjecture that they could be the reverberation of noises made by insects on the shore, conveyed along the surface of the water, for they were loudest and most distinct at those points where the nature of the land, and the intervention of the fort and its buildings, forbade the possibility of this kind of conduction." In fact, similar sounds have been heard issuing from the sea in the harbour of Bombay, and near the landing-place at Caldera in Chili. In the last-mentioned locality they rise and fall as much as four notes. We may add the well-known fact that some fishes grunt when disturbed, and even oysters have an acoustic apparatus, though it does not rise to the dignity of an ear.

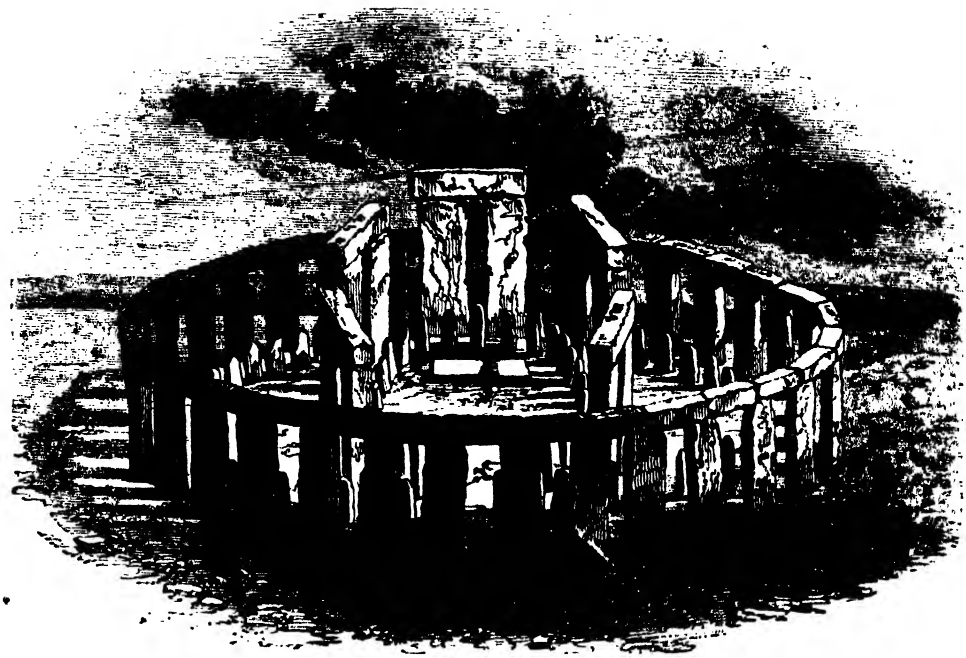
When Sir Emerson Tennant first communicated his observations at Batticaloa to the Edinburgh Philosophical Society, Dr. Grant experimented with some specimens of a mollusc (*Tritonia*) by placing them in a glass vessel filled with sea-water. This vessel was placed on the central table of the Wernerian Natural History Society of Edinburgh, around which many members were sitting. During the whole time of the meeting, a "clink," as of a steel wire struck on the side of the jar, was heard at intervals, and so distinctly that it extended to the distance of twelve feet.

Wonderful Relics.

STONEHENGE.

Stonehenge, one of the most remarkable of ancient monuments in these islands, and destined to puzzle, as to its origin and use, geologists and antiquaries alike, is situated on Salisbury Plain, about seven miles north of Salisbury, and three miles west of Amesbury. It lies nearly at the apex of a triangle formed by the junction of two roads, one leading north to Heytesbury and Warminster, the other south to Steeple Langford and Wily. On the former road, at about 100 yards from the junction, is the Avenue, marked on each side by a bank and ditch, and extending on the right across the turnpike-road for a distance of 594 yards; and on the left past a large stone sixteen feet high, standing by itself by the wayside, called the Friar's Heel, in a direct north-east direction to the entrance of the temple. That this was the only entrance, is rendered probable from the fact that round the whole of the work is a ditch crowned in the inner circle by a small ridge of earth or *vallum*, measuring 369 yards in circumference.

The accompanying cut shows Stonehenge as it is supposed to have appeared when perfect. At present there are but very few of the uprights left standing, and the stones are scattered about the



STONEHENGE RESTORED.

ground without much appearance of order. Still, it is not difficult for the traveller to imagine what its original shape was.

As is seen by the cut, the temple itself consisted of two circles and two ovals. At a distance of 100 feet from the ditch, and measuring 300 feet in circumference, is the outer circle. This consisted of thirty huge upright stones, varying in size and form; those of the entrance being thirteen feet high, while the average height of all of them was sixteen feet, the width six and seven feet, and the circumference eighteen feet. Above these were placed horizontally, as a lintel to a doorpost, oval-shaped blocks about twelve feet long and two feet eight inches deep. The upright stones taper a little towards the top, and show, from the slight grooves made to receive the imposts, that the mortices, as they are called in masonic language, have been scooped out by tools. The imposts or tenons were placed touching each other, so as to form a complete circle. There are now but seventeen of the uprights remaining, and but six of the lintels. The space between each upright varies somewhat, but averages about three and a half feet. That of the entrance is wider, being five feet. At exactly eight feet three inches from the outer is the inner circle, composed of smaller but even ruder stones, originally forty in number, but of which only twenty remain. On the assumption that the building was a temple, it has been conjectured that these stones were votive offerings, made after the temple was finished. The next enclosure was in the shape of a horse-shoe, and was formed of ten upright stones placed in pairs at regular intervals, each pair having a third stone placed over them as in the outer circle, but not, as in the outer circle, touching each other. These gigantic *trilithons*, or combination of three stones, are the chief characteristics of the place, and when it has been found by measurement that one of those now standing cannot weigh less than seventy tons, the impost alone weighing eleven tons, it is not surprising that the old tradition should have been that they were brought there and placed in their positions by the supernatural agency of Merlin. They were not all of a uniform height, but rose gradually from east to west. The two pairs nearest the spectator, opposite to each other at a distance of about forty feet, are about sixteen feet three inches high; the next pair is seventeen feet two inches; while one of the uprights of the great central pair facing the entrance measures twenty-six feet six inches. There is only one of the uprights of this central trilithon now standing, and that is nine inches out of the perpendicular, and is apparently supported by one of the smaller stones of the inner oval. The fallen impost is fifteen feet six inches long. Of the five trilithons, but two are now entire, though it might have been thought that, "by their own weight made steadfast and immovable," nothing less than the shock of an earthquake could

have overturned them. That next to the great central stone fell on the 3rd January, 1797, backwards, the impost in its fall striking a stone of the outer circle. One upright of the next pair still remains; the other and the impost have fallen forwards, each of them lying broken into three pieces. The inner oval is supposed to have consisted of nineteen stones, though traces but of eleven can now be found. They are about seven and a half feet high, and measure twenty-three inches round at the base, and twelve inches at the top. These two ovals formed the sanctum or cell, and the altar-stone stood in the inner enclosure, in front of the great trilithon, which has nearly covered it in its fall. It measures fifteen feet in length.

Such is this wonderful monument of the prehistoric age, including in the area contained within the ditch one acre and a quarter of ground.

By what means the stones were brought there is still a matter of doubt. The greater part of the stones themselves, those of the outer circle and the large trilithons, are all rough stones, taken from the quarry in their rude state, and are a species of siliceous or flinty sandstone. Numbers of these are to be found in Wiltshire, and are known by the name of *Grey Wethers*. Those of the inner circle and smaller oval are of a different species, and their presence is not so easily accounted for. For what purpose the building was erected has been a matter of great speculation among antiquaries. It has been supposed to have been a monument erected to the memory of the dead buried in the numerous barrows adjoining it, or that it was an astronomical observatory, but it is now generally admitted to have been a Druidical temple. Whatever it may have been, it is, and as long as it remains it always will be, one of the most interesting relics of bygone ages.

of Animal

MUSCULAR POWER IN BEETLES.—Mr. Gosse relates the following anecdote of a three-horned beetle, the *oryctes maimon*, which is not larger than the ordinary English stag-beetle:—"This insect has just astonished me by a proof of its vast strength of body. When it was first brought to me, having no box immediately at hand, I was at a loss where to put it until I could kill it; but a quart bottle full of milk being on the table, I clapped the beetle for the present under that, the hollow at the bottom allowing him room to stand upright. Presently, to my surprise, the bottle began to move slowly, and glide along the smooth table, propelled by the muscular power of the imprisoned insect, and continued for some time to perambulate the surface, to the astonishment of all who witnessed it. The weight of the bottle and its contents could not have been less than three pounds and a half, while that of the beetle was about half an ounce; so that it readily moved a weight 112 times exceeding its own. A better notion than figures can convey will be obtained of this feat by supposing a lad of fifteen to be imprisoned under the great bell of St. Paul's, which weighs 12,000 pounds, and to move it to and fro upon a smooth pavement by pushing within."

SAGACITY OF THE RAVEN.—Mr. R. Ball communicated the following anecdote of this species to the author of "Thomson's Irish Birds." When he was a boy at school, a tame raven was very attentive in watching their cribs or bird-traps, and when a bird was taken, the raven endeavoured to catch it by turning up the crib; but in so doing the bird always escaped, as the raven could not let go the crib in time to seize it. After several vain attempts of this kind, the raven, seeing another bird caught, instead of going at once to the crib, went to another tame raven, and induced it to accompany him; when the one lifted up the crib, and the other bore the poor captive off in triumph.

THE PALACE OF WATERS, CONSTANTINOPLE.

AMONG the wonders of the world, a hall or palace of imposing grandeur, the roof of which is supported on massive pillars standing in a vast expanse of water, and formed of ponderous stone arches, the very extent of which is unknown and its origin enveloped in mystery, but which was nevertheless suddenly discovered by an accident to underlie the foundations of the capital city of a great nation, may surely claim no insignificant place. Such is Yèrè-Batan Seraï, which not more than forty years ago was discovered, by the falling in of some of its arches, to exist beneath Constantinople. The approach to it is through a house, after entering which the visitor passes through the entrance-hall into a courtyard, and descends a steep slope of slippery earth, when he finds himself at the opening of the dim and mysterious Palace of Waters.

The roof of this enormous cistern, which is formed of massive circular arches, is supported by magnificent marble columns about ten feet apart. Their capitals are of the Corinthian order, and are in many instances elaborately carved, one near the entrance being covered with exquisitely sculptured ornaments, and each pillar being formed of a single block.

At the time of the visit of the writer to whom we are chiefly indebted for information on this subject, Constantinople had long been suffering from drought, so that the stateliness of the effect was augmented by the lowness of the water, which gave greater height to the stupendous subterranean abode. A

boat used once to be moored on the water, but the Effendi who owned the house through which the palace is approached had had it destroyed, to prevent loss of life in attempts to explore the extent of the vast hall. Two Englishmen had previously made the attempt, but in both cases without success, and in one with a fatal result. The first of these travellers, about 1830, not satisfied with gazing on the wonders of the palace from its opening, sprang into the boat, and with the waterman who used frequently to row the family of the owner of the dwelling-house above mentioned near the entrance, pushed off. Those on the shore earnestly begged him to return, and warned him at least not to lose sight of the light, but to no purpose. Producing a lamp with which he had provided himself, he rowed on regardless of the shouts of his friends, having, as is supposed, induced the boatman by the promise of a heavy reward to comply with his wish. The flame of his lamp appeared fainter and fainter, and was finally altogether lost to the sight of those who had seen him depart, and who now anxiously awaited his return. But they lingered in vain, and had looked their last on the unfortunate men who had so rashly risked their lives in an adventure which, if successful, could not have been worth a risk so fearful. It can only be presumed either that they perished in a current of foul air, or that, bewildered among the columns in their attempt to return, they died miserably of hunger.

The other attempt to explore the extent of this marvellous hall took place but a few months before the visit of the narrator, and was attended with so much of success as to show that its extent is but inadequately described as vast, while, happily, it was followed by no fatal result. Another Englishman requested permission to use the boat which had replaced the one so unhappily lost, for an exploring expedition. Objections were raised in vain; the adventurer was bold and persevering, and at length, on his repeated promises of caution, the Effendi gave his reluctant permission. No one ventured to accompany the explorer on "the terrible track," and he accordingly set out alone, having first fixed two lighted torches to the stern of his boat, and tied one end of a quantity of strong twine to one of the pillars near the entrance, leaving it to unravel itself from a reel as he went along. The flame of his torch gradually faded from view, and the fourth hour from his departure had nearly expired when a faint gleam of light once more appeared in the distant darkness, to the inexpressible relief of those who were anxiously watching for his return. In but a little time afterwards the wanderer sprang from the boat chilled and exhausted, and in answer to the inquiries of his friends, said that he had gone on for two hours in a straight line, but had seen nothing more than they themselves could see—the vaulted roof overhead, the water beneath him, and long avenues of columns stretching around him in all directions, and losing themselves in the darkness.

This second adventure so alarmed the worthy old Osmanli to whom the boat belonged that he at once had it destroyed, and visitors have since been compelled to content themselves with such a view of Yèrè-Batan Seraï and its marvels as can be commanded from the brink of its unexplored, and, as it hence appears, inexplorable lake.

The spot which afforded the view from which this description was written does not appear to be the legitimate entrance, but was nevertheless the locality in which the first lapse of a portion of the fabric gave evidence of its existence, and no entrance is known but such as have been discovered in a similar manner. Another such failure in a yard near the Sublime Porte revealed its extent in that direction; a third also occurred at another time near the mosque of St. Sophia; and a fourth within the walls of the Record office; which facts, joined to the negative discovery of the second and more fortunate of the two above-mentioned English travellers, prove that it extends over a space of many square miles beneath the city. Beyond what has been thus stated, the authorities of Constantinople can throw no light either upon its extent or its history. But as the narrator truly says, the very mystery which surrounds Yèrè-Batan Seraï serves but to add to its interest.

Wonders of Vegetation.

THE RAFFLESIA.

"COME with me, sir; come! A flower, very large, beautiful, wonderful!" exclaimed a Malay, who drew the attention of Dr. Arnold to a flower remarkable alike for its enormous size and its anomalous structure and habit. And the surprise of the Malay was nothing compared with that of Dr. Arnold and his companions, Sir Stamford and Lady Raffles, when, following their native attendant, they saw among the bushes of a jungle a flower apparently springing out of the ground, without stem or leaf, and measuring at least a yard in diameter. The first news of this remarkable discovery created a great amount of curiosity in Europe, and no papers ever read at the Linnæan Society can be compared, for the interest they excited, with those in which the illustrious Robert Brown described this wonder of the vegetable world.

Sir Stamford Raffles having been appointed governor of a settlement in Sumatra, and impelled by his great love for Nature, resolved to explore that little-known island. On his first journey, in 1818, he took with him Dr. Arnold, an ardent and promising naturalist, who died as a new world was opening before him. He, however, discovered this gigantic flower; his drawings and descriptions were left unfinished, but his patron carefully pre-

NATIVE FOREST IN SUMATRA, WITH SPECIMENS OF RAFFLESIA ARNOLDII, IN FLOWER AND BUD.

THE INDIAN FAKIRS.

Perhaps the most wonderful of all instances of religious fanaticism is that presented by the Fakirs of India and other countries of the East. In all ages and countries, men have been known to inflict upon themselves bodily suffering from mistaken religious zeal. The natural religious instinct universally found in man leads him frequently to inflict upon himself grievous penalties for sins either real or imaginary; and wherever Christianity does not exert its benign influence, we find this tendency occasionally exercised in ways repulsive and abhorrent to the general feelings of humanity. Even Christianity itself, in some of the forms by which men have debased it, has not been free from fanaticism of the same description, many of the professedly religious orders having, even down to the present time, systematically practised self-punishment in one shape or another. On this portion of the subject it is not our province to enlarge. We purpose to deal now with religious fanaticism simply as exhibited by the Fakirs.

AN INDIAN FAKIR.

The Fakirs of the East Indies are a very large class, numbering, it is believed, more than three millions of people, of whom about three-fifths are adherents of the Hindoo, and the remainder of the Mohammedan religion. The word *fakir* is of signifying *poor* or *beggarly*, and is those enthusiasts who separate themselves from the ordinary pursuits of the life around them, to give their whole time to religious observances, and the practice of self-mortification. The Fakirs are of different grades, some bearing a respectable character for learning and piety, according to their religion, whether Hindoo or Mohammedan; while others, forming the mass of the order, are signalised only by their wretched condition, and the disgusting character of the inflictions which they impose upon themselves. There are among them also, it must be remarked, a large number of impostors, who make a trade of their spurious form of self-denial, and adopt it merely as a cloak for all kinds of crimes.

The Fakirs generally go entirely naked, and live in caves and holes, whence they occasionally start out to supplicate the passer-by for charity, sometimes for themselves, but more frequently as an offering towards the building of a temple, or in honour of a god. Many of them present deplorable spectacles, with the body unclothed and filthy, and the hair and nails allowed to grow to a frightful length. Some bend the body into a painful and unnatural position, from which at last they have no power to raise it; others tie round them heavy weights and chains, which gall and eat into the flesh; many crawl about continually on their hands and knees, or roll over the ground from place to place for hundreds of miles without attempting to regain the erect posture. One writer says, "I have seen a man who had made a vow to hold up his arms in a

perpendicular manner above his head and never to suspend them, until he totally lost the power of moving them. He seemed more like a wild beast than a man; his arms, from having been so long in one posture, were become withered and dried up, while his outstretched fingers, with long nails of twenty years' growth, had the appearance of extraordinary horns; his hair, full of dust and never combed, hung over him in a savage manner; and except in his erect position, there appeared nothing human about him. This man was travelling throughout Hindustan, and being unable to help himself with food, women of distinction among the Hindoos contended for the honour of feeding this holy person wherever he appeared. I saw another of the devotees who had made a vow to fix every year a large iron ring into his body, and thereto to suspend a heavy chain, many yards long, to drag on the ground. I saw this extraordinary saint in the seventh year of his penance, when he had just put in the seventh ring, and the wound was then so tender and painful, that he was obliged to carry the chain upon his shoulder until the orifice became more callous." Another example of self-imposed torture and bodily contortion is depicted in our illustration.

The Fakirs sometimes submit to tortures of another description, such as roasting before a slow fire, or hanging suspended by hooks thrust through their flesh. An American missionary thus describes a spectacle of this kind which he had witnessed:—"I was residing upon the sea-shore near the spot where the cruel festivity was to occur. At mid-day the multitude began to assemble, and before five o'clock the crowd could not have been less than five thousand persons. A beam about forty feet in height had been erected, across the top of which was placed a transverse pole of smaller size, to each end of which was tied a rope; the end of one rope trailed upon the ground, while to the shorter one were attached two iron hooks, strong, rounded, smooth, and sharp-pointed. The devotees were retained in an adjoining temple until the fitting hour arrived. One of them was then led out, preceded by Brahmins, and musicians, and friends. He approached the upright pole, lay upon his face while the hooks were thrust under the flesh on either side of the vertebræ, just below the shoulder-blade, and then, the other ropes being well manned, he was hoisted up in mid-air, and swung round and round to the number of ten to thirty times, according as strength allowed, or the vow made necessary. Twenty or more went through this ceremony that afternoon, many of whom, by way of manifesting their indifference to pain, scattered flowers and fruit, beat a tomtom, or smoked a cigar. Being sceptical as to the statement that the hook went into the flesh, and was supported by it alone, unaided by any exterior bandage, I went near enough to convince myself that such was the fact, and that no deception was practised. The muscles are strong, and accidents from falling seldom occur."

The origin of Fakirism is lost in antiquity. There is a tradition to the effect that the first Fakir was an Indian prince, who made a vow to lead a life of penury and self-mortification, and to found an order of his countrymen who should habitually practise the same mode of life; but history does not tell us of any such person. The early Fakirs were known to the Greek and Roman world as *gymnosophists* (from the word *gymnos*, naked), and Alexander the Great, when pursuing his conquests in Asia, about 320 B.C., was astonished to meet men who lived habitually in bodily pain, and voluntarily submitted themselves to cruel tortures.

Wonders of Vegetation.

THE MOUNTAIN CABBAGE TREE.

THIS magnificent palm is described by Pinckard, in his "Notes in the West Indies," as unquestionably the finest tree that is known. This traveller saw it growing in a wood at Barbadoes—of a peculiar kind, and different from all others in the island. From words or drawings, only an imperfect idea of it can be collected; and, to comprehend its fine symmetry, its grandeur, and majestic loftiness, it must be seen. Its trunk is very smooth, and almost regularly cylindrical, rising into a superb and stately pillar, resembling a well-hewn column of stone. At the base, its circumference is somewhat greater than at any other part, yet lessening so gradually upwards, as to preserve the most just and accurate proportions. Not a single branch, not even the slightest twig, interrupts the general harmony of the trunk, which often rises in a correct perpendicular, to the height of from sixty to one hundred feet, and then spreads its palmated foliage into a wide and beautifully radiated circle. Branches it has none, but the fine expansive leaves shooting immediately from the summit of the trunk, extend around it, crowning, and, as it were, protecting the massy column, in the form of a well-spread umbrella.

"It may perhaps, be thought that our noble English oak, with all its rude and crooked limbs, must be a more picturesque object. So it is, and so is also the wide branching silk-cotton; but the loftiness, the stately grandeur, the exact proportion, and the deep shading foliage of the mountain cabbage are unequalled, and in their happy combination crown this tree the king of the forest, the most exalted of the vegetable world.

"When planted in avenues, it forms a grand and imposing approach to a dwelling, conveying an air of greatness to the mansion which it adorns. It

grows free from decay to a very old age, but cannot be converted to the useful purposes of timber. It is a tree of state, calculated to enrich and augment the magnificence of a palace: nor let it detract from its majestic qualities, to know that after all it is but a cabbage tree! Its loftiest summit is a spiral succulent shoot, the sides of which, by gradually and successively unfolding, form the fine wide-spreading foliage. Before this opens to expand itself around, it is a congeries of young and tender leaves, in which state it is often boiled and brought to table as a cabbage, of which it is the very best kind. It is also used without boiling, by way of salad, and is then eaten with oil and vinegar; and so highly is it esteemed for these culinary purposes, that too often a very fine tree has been devoted to the axe, merely because no other means could be found of obtaining from its towering summit this most excellent cabbage."

The Snake Nut.—This is one of the most remarkable productions of the vegetable kingdom. It is found in British Guiana, and specimens are occasionally brought down to the coast for sale as curiosities to the passengers by West India steamers, but it has so rarely been brought to this country that it is comparatively unknown. When a few specimens were first brought over by a gentleman from Demerara, about ten or twelve years ago, one was forwarded to and courteously accepted by Her Majesty. The nuts vary in size from about a small walnut to that of an ordinary egg, and the kernel closely resembles a small boa constrictor, coiled up as if asleep. While the nut is unripe, the kernel can be uncoiled, and its resemblance to the body, fang, and tail of a reptile is most extraordinary.

WONDERS OF MINUTE WORKMANSHIP.

In the twentieth year of Queen Elizabeth a blacksmith named Mark Scaliot made a lock consisting of eleven pieces of iron, steel, and brass, all which, together with a key to it, weighed but one grain of gold. He also made a chain of gold, consisting of forty-three links, and, having fastened this to the before-mentioned lock and key, he put the chain about the neck of a flea, which drew them all with ease. All these together, lock and key, chain and flea, weighed only one grain and a half.

Oswaldus Norhingerus, who was more famous even than Scaliot for his minute contrivances, is said to have made 1,600 dishes of turned ivory, all perfect and complete in every part, yet so small, thin, and slender, that all of them were included at once in a cup turned out of a pepper-corn of the common size. Johannes Shad, of Mitelbrach, carried this wonderful work with him to Rome, and showed it to Pope Paul V., who saw and counted them all by the help of a pair of spectacles. They were so little as to be almost invisible to the eye.

Johannes Ferrarius, a Jesuit, had in his possession cannons of wood, with their carriages, wheels, and all other military furniture, all of which were also contained in a peppercorn of the ordinary size.

An artist, named Claudius Gallus, made for Hippolytus d'Este, Cardinal of Ferrara, representations of sundry birds sitting on the tops of trees, which, by hydraulic art and secret conveyance of water through the trunks and branches of the trees, were made to sing and clap their wings; but, at the sudden appearance of an owl out of a bush of the same artifice, they immediately became all mute and silent.

TRADE WINDS.

That there should be a wind ever constant from the same quarter all the year round, is, apart from the causes of it, a wonderful fact. Of almost every wind that blows except the trade wind, it might be said literally, "The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, nor whither it goeth." Of the Trade Winds, however, it may be said that in the northern hemisphere they blow regularly from N.E. by N. to N.E. by E., and in the southern hemisphere from S.E. by S. to S.E. by E. They can be surely counted on as infallible incidents in a voyage.

Columbus first discovered the full extent of the N.E. trade winds, when he made his first voyage to America. Previously he had observed in the neighbourhood of the Canaries the frequency of the winds from the same quarter, but it was not till he set out on his first American voyage that he ascertained the extent over which they regularly prevail. The story is well known about the anxiety of Columbus's crew, how they noticed, when well to the westward of Grand Canary, the perpetual breeze from north-east; how they expressed their fears about getting back to Europe, declaring that God was angry with them for presuming to pry into his secrets in the West, and had given them over to the power of the devil, who caused a wind to blow which should ever prevent their return to Spain. Columbus, while he succeeded in overcoming the fears of his sailors, and taught his successors how to sail round the wind which he could not sail against, never seems to have understood the cause of the phenomenon.

So far as the name is concerned, it may be pretty safely concluded that it was given because the wind was the sure promoter of commerce, a wind upon which the merchant might certainly count to carry his ships over a known distance of the voyage. As regards the direction from which it blows, when the sun is south of the equator the wind has a little more north in it, and is variable between N.E. and N.N.E. When the sun is north of the line the

wind is more easterly, blowing sometimes from E.N.E.

The extent of the trade wind region depends entirely upon the sun. When the sun has a southern declination the trade wind is often not found till the twenty-seventh degree of north latitude; but with a northern declination of the sun the wind gets as far north as thirty-two degrees. Its influence is perceived at from two to seven degrees north of the equator, so that the district over which the wind blows may be estimated at about twenty-two degrees of latitude. The force of the wind is sufficient to propel a ship regularly at the rate of seven to eight miles an hour.

The causes of these winds were suggested by many speculators upon science, even in the olden time; but modern science, which is able to declare absolutely things once thought to be beyond man's ken—to fix the distances between planet and planet, to predict with certainty future scientific events, to foreknow the tides, and to describe the journeys yet to be performed of whole armies of stars—is, among other things, able to speak with assurance even about the winds in their circuits. Times have changed since the Inquisition made Galileo discredit the witness of his senses; since Columbus was threatened with violence for persisting in his voyage of discovery; and—last, not least—since Charles II. posed the Royal Society with his well-known question about the difference in weight between a salmon alive and the same salmon dead. The times have changed, and we with them. Opportunities for scientific investigation are not only ten thousand times more abundant, but the people as a whole are more ready, thanks to the general spread of knowledge, carefully to use the means they have.

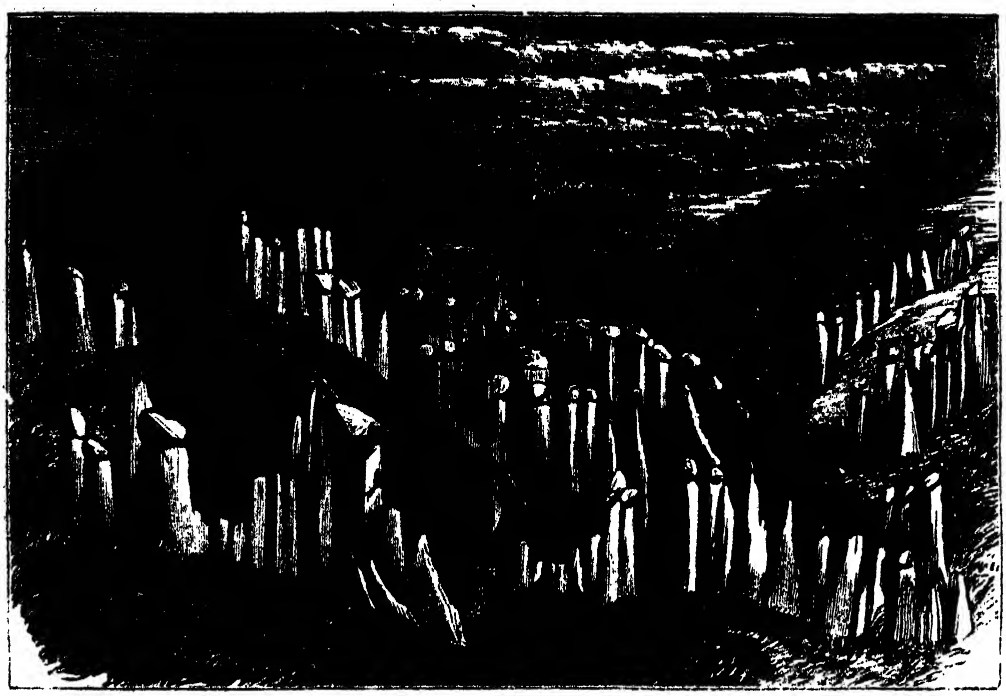
The trade wind theory now accepted may be thus explained:—At either pole is a region of calms, estimated at from one to one and a half degrees in extent. Outside this is a district extending for many degrees, over which prevail winds running from all directions towards the pole. Beyond this are the calms of Cancer and Capricorn, in the northern and southern hemispheres respectively; then the north-east and south-east trade winds, and between them the belt of equatorial calms and rains. Such are the facts. Now the rotatory motion of the earth from west to east being kept in mind, it will be readily understood that a current of air coming from the north pole, where the earth's motion is scarcely felt, towards the equator, would, the further it travelled south, find itself more and more affected by the rotatory motion. The earth would be, as it were, slipping from under it, going from west to east, so that the current which was flying south would find that it did not go in a straight line, but would get sent away westward, and would blow, therefore, from the north-east; in the same way, the south wind coming north would be converted into a south-east wind.

Now the prevailing winds between the polar calms and the calms of Cancer are winds which blow towards the pole, so that the current of air which blows towards the equator must overrun them—as, in fact, it does till it reaches the thirtieth parallel of north latitude. There it meets with a counter-current of equal strength; and the two irresistible bodies meeting, cause a pressure or stagnation in the air at the point of contact, the stagnation produced being the calms of Cancer, which stretch over five or six degrees of latitude. Either opponent being unable to conquer, both descend—the north wind to pursue its southerly course to the equator, the south wind to fly onwards to the north pole. The wind which the northern giant met at parallel thirty was a south-west wind, which had blown above and across the extent traversed by the north-east trade. Its history does not differ materially from that of its rival, except that at parallel thirty it has nearly done its travels, whereas the north wind is only just beginning. One wind has made the circuit of the globe, as the wind it meets will have to make the circuit. It has started from the south pole along the upper road (*mutatis mutandis*, the phenomena of the southern hemisphere are like those of the northern), has encountered the strong north-east wind which overlies and overblows the south-east trades, has pushed against it so hard as to repeat at Capricorn what was done at Cancer, and has swept resistlessly over thirty degrees of latitude as the south-east trade wind. At so near the equator it has been met by the north-east trade wind. The two winds have been hurled at one another with a momentum acquired in a run over thirty degrees of latitude apiece, and have been forced to scale the heavens in order to avoid each other. Away they rush northward and southward respectively.

The conflict which takes place between the winds at the equator, if not more fierce than that which occurs at Cancer and Capricorn, has more visible effects. To it must be attributed those strange convulsions which often make the equatorial region anything but a calm one: those fierce deluges of rain which sweep down from the clouds in sheets, that lightning and that thunder, which are the concomitants of the mighty battle that is being perpetually fought for the supremacy of north and south.

The trade winds are perceived within the same parallels all round the world, the only difference observable being in those parts where local winds, land breezes, and monsoons affect them, and turn them out of their course.

"The wind goeth towards the south and turneth about unto the north; it whirleth about continually, and the wind returneth again according to his circuits."



THE EARTH PILLARS OF BOTZEN.

UMBRELLA STONES.

THERE is something wonderful in the constant rush of muddy water out of rivers into seas and oceans, for every drop of it contains a small portion of solid matter which was once part of the dry ground. The rivers devour, as it were, the crumbling soil of the hills adjacent to them, and transmit it to the sea. Rivers arise from streams and torrents, and these are produced by the rain, the persevering destroyer and carrier of the surface of the earth. Ever since rain and dry land existed, the wear and tear has gone on, and the sea has received the sediment. Mountains have been worn down, hills have disappeared, valleys have been excavated, and plains have been lowered, and all by the action of rain and rivers.

But there are some remarkable instances where the effects of rain, without rivers, in eating away hundreds of feet of hard soil, can be very readily studied. In the Tyrol, near Botzen, hundreds of tall columns of hard mud, varying from 20 to 100 feet in height, and usually capped by a large stone, have been separated from the ridges of the valleys of which they once formed a part. The columns occur on the sides and at the bottom of the valleys, and they are very elegant in shape. The lower parts of the columns are usually flat on the sides, so that they are tall pyramids, and not simple cones. The mud out of which they were formed once filled the valleys, and was produced by the grinding down of the adjacent hills by an old glacier as well as by the effects of rain. The stones strewed over the mud were brought down by the glacier, and were scratched and polished by the ice as by a tool. The mud, although intensely hard from age, began to be worn here and there by rain, but not beneath the capping-stones; and these natural umbrellas effectually kept off the drizzle of centuries and its results. Year after year the soil uncovered by the stones was washed away, and, of course, as it diminished, the columns stood up more and more. During the lapse of ages, the mud of the system of valleys was worn away, leaving the gigantic stone-capped columns as proofs of its former depth. Rain has cleared out of the valleys a dense mud as deep as the highest column, and there could have been no river action, for it would have washed the slender columns away. When one of the columns loses its stone, it becomes sharp and spire-shaped, and the whole diminishes in height and size.

Curiously enough, there are some large stones in the mud of the columns, and when some of these are diminishing in height from the loss of their umbrella stone, one of the included stones acts as a second cover, and preserves a small relic of the former structure. Sir Charles Lyell measured one of these umbrella stones, and found it to be ten feet across, and the pillar of densely hard mud it capped was sixty feet high. If the drainage of the valley should remain as it is, and no earthquake

should occur, there is no reason why the columns should not remain as they are, and enjoy their protection from the rain for centuries.

There were once some fine mud columns, with umbrella stones upon them, in the valley of the Visp, near Zermatt, in Switzerland; but an earthquake threw down many of the stones, and even some of the columns. One column, which was thus destroyed in 1855, had a height of fifty feet, and its umbrella stone was fifteen feet in diameter. The earthquake, moreover, altered the drainage of the valley, and a stream began to destroy the lower parts of the columns by its rushing force.

In order to produce a column of fifty or sixty feet, capped by a gigantic stone, it is evident that a corresponding wearing away of surrounding soil must take place. This wearing away is the result of the slow action of rain, and thus the height of the stone-capped column is a test of the wear and tear by rain which occurred after the original valley had been filled with mud. Similar stone-capped columns occur, but of a very different material, amongst the glaciers of the Alps. The glaciers are great seas of ice which fill up the gorges and valleys of the highest Alps, and which in a slow downward movement wear away the rocks which bound them. Great blocks of stone fall on to the glaciers, and now and then, when the wasting of the ice in its downward movement is very rapid, these blocks act as preservers to the ice immediately beneath. Stone-capped columns of ice are thus formed, and the umbrella stone acts also as a sun-shade. There is an interesting connection between the Tyrolese mud-columns and the Alpine icy columns, for the former are remnants of a mud which was deposited from an old glacier in the Botzen valley, and it is, therefore, quite possible that some of the umbrella stones capping the mud columns may have been sun-shades to the ice columns of the ancient mud-depositing glacier.

POWER OF BEARING EXTREME HEAT.

THE writer remembers a terrible story published many years ago, of a fire at a brewery. The narrator, trying to escape, had no alternative but to jump into a copper vat, at the bottom of which was a little heap of brick and mortar rubbish, on which he stood. The vat became red-hot around him, and yet he was rescued without having sustained any material injury beyond the fright. Many facts similar to this are recorded by Sir David Brewster in his "Letters on Natural Magic." The best known of these incidents are the experiments made by M. Tillet, in France, and by Dr. Fordyce and Sir Charles Blagden in England. These gentlemen went into a room, the heat of which exceeded 260°, and though Sir Charles Blagden's pulse rose to 144 beats, or double its ordinary quickness, no harm ensued. In order to prove that there was no mistake as to the degree of heat endured, several steaks were cooked and eggs roasted in the same place. Messrs. Duhamel and Tiller testify by their own experience that at Rochefoucault, in France, the girls who were accustomed to attend to the ovens of a bakehouse were capable of enduring for ten minutes a temperature of 270°. It will, of course, be remembered by our readers that water boils at 212°.

Sir F. Chantrey, the celebrated sculptor, proved in his own person that the human body is capable of bearing very much higher temperatures than any we have mentioned. The furnace in which he dried his moulds was about 14 feet long, 12 feet high, and 12 feet broad. When raised to its highest temperature, with the door closed, the thermometer marked 350° of heat, and the iron floor became red-hot. Nevertheless, Chantrey's workmen often entered it at a temperature of 340°, walking over the red-hot iron floor with wooden clogs, which became charred on the surface. On one occasion, as Sir David Brewster relates, Chantrey himself, accompanied by five or six of his friends, entered the furnace, and after remaining two minutes, they brought out a thermometer which marked 320°. Some of the party experienced sharp pains on the tips of their ears, and in the septum of the nose, while others felt a pain in their eyes.

Wonders of Construction.

THE EDDYSTONE LIGHTHOUSE.

"NOTHING but wood could possibly stand on the Eddystone," said the Brethren of the Trinity House, when it was proposed to rebuild with stone the wooden lighthouse which in December, 1755, was destroyed by fire. This was not the opinion of John Smeaton, the engineer who was entrusted by the concessionary of the Eddystone to repair the damage; and he had abundant reason to warrant his belief. There had been already two lighthouses of wood upon the rock. The first, commenced in 1696, by Henry Winstanley, was three years in building, and, judged by the event and by the light of subsequent experience, was defective both in principle and construction. In November, 1703, Winstanley, who was very proud of his work, and very confident of its durability, was lodging at his lighthouse, and expressed a wish that the fiercest storm that ever blew might come on while he was there. The fiercest storm that had raged within then living memory did come on the night of November the 26th; and when, on the morning of the 27th, men looked for the lighthouse not a vestige of it was visible. With the builder and his workmen it had been swept away.

EDDYSTONE LIGHTHOUSE.

The necessity for placing a beacon upon so dangerous a set of reefs as the Eddystone rocks was thrust forcibly upon the public attention by a number of disastrous wrecks that followed the destruction of Winstanley's lighthouse; and the Parliament of the day authorised a tax of one penny a ton upon all vessels outward and inward, for the benefit of the man who should again mark the reef with a light. John Rudyerd was the engineer employed by the purchaser of the right to build, and he, with extraordinary ingenuity, with wonderful patience, and with great skill, succeeded in once more planting a lighthouse on the dreadful spot. Though he avoided the glaring defects of his predecessor's contrivance—defects, indeed, which made it wonderful that the structure should have outlived four winters' storms—he adhered to the notion that the house must be of wood, and his lighthouse therefore was of that material. In 1706, John Rudyerd's work was finished, and for forty-nine years it braved triumphantly the attacks of wind and sea. There is not any reason for supposing that it might not have continued much longer—until its timbers should have rotted, in fact—but it had in its very nature the principle of destruction. On the night of the 2nd of December, 1755, but under what circumstances it is not exactly known, the dried and sooty rafters of the lantern were found to be on fire, and the inmates of the lighthouse could not subdue the flames. Driven from floor to floor as the fire worked downwards, the men were at last obliged to seek shelter under a ledge of the Eddystone rock itself, and in this dreadful position, fourteen miles from land, to await the succour which came off from the shore when the catastrophe of the lighthouse was apprehended. The lighthouse was totally destroyed, and when, a year afterwards, John Smeaton surveyed the site, he had difficulty in recognising where the old structure had stood.

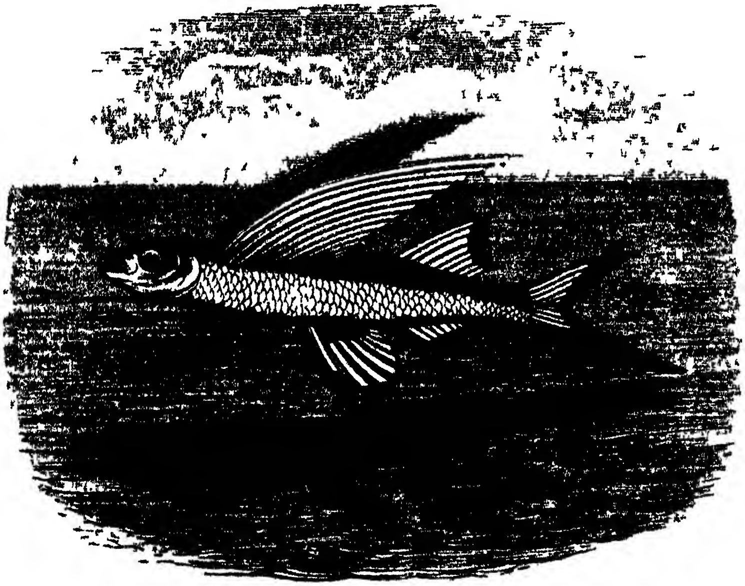
In spite of the opinion strongly entertained at the Trinity House, Smeaton, who was entrusted with the work of rebuilding the beacon, decided upon using stone and not wood. One wooden building had been washed away, and another had been burned, and he was resolved that if he could help it the thing which had been should not be the thing that might be in the matter of the Eddystone Lighthouse. With infinite care, with untiring industry, with an incessant personal application that savoured of devotion, Smeaton set to work. In the face of difficulties from foul weather—and these were often of a character wholly to prevent work for days together—in the face of engineering and mechanical difficulties, for which the science of the day had not any remedy, and which had to be overcome by the suggestions of his own genius, Smeaton persevered—often discouraged but never cast down; never advancing a step without first being thoroughly persuaded it was a wise one, never having cause to regret a single step he had taken.

The work was indeed wonderful, both in design and execution. The idea of building a house, not merely on a rock, but into a rock, so that it should be identified undistinguishably with it, was in itself a lofty one, such as no engineer had yet conceived. The necessity, perhaps, had not arisen with the same force as in the case of the Eddystone, but there the necessity was overwhelming. The Eddystone rocks are a set of reefs fourteen miles from Plymouth, right in the fairway of ships bound up or down Channel, and washed, not only by the great Atlantic wave, but torn also by the ground sea, and subjected to all the violence of the tide. Rearing their heads in the path of so many mighty forces, they have to endure all their rage in succession, and to receive the blows which they deal in the very height of their anger. "Even in summer," wrote Winstanley, the builder of the first lighthouse, "the weather would at times prove so bad that for ten or fourteen days together the sea would be so raging about these rocks, caused by outwinds and the running of the ground seas coming from the main ocean, that although the weather should seem and be most calm in other places, yet here it would mount and fly more than 200 feet." In rough wintry weather the waves rear against and strike the stony edifice with a force that makes it tremble, and they roar at their own discomfiture. Wonderful was the undertaking to attempt work on such a place. Wonderful also was the work. Carefully, thoroughly, wisely, did Smeaton consider every principle that could possibly help him, and his own hands commenced the execution of every detail, his own eye superintended the entire work. By a wonderful adaptation of the principle of dovetailing, he knitted every stone to every other stone, and wove the whole foundation into the fabric of the rock. To large central stones the whole of the outer stones were bound, and so the courses, joined as well as cemented together, were piled one upon the other till the whole became a mass of solid masonry, tied in unbreakable union to each other and the rock. Upon such a foundation the upper part of the lighthouse was built, and was finished on the 9th of October, 1759. Since that time till the present, Smeaton's work has stood unmoved and immovable, save by a power which should rend and tear the Eddystone itself. The storms of a century have burst upon it, the most terrific waves, the most dreadful winds have beaten upon it, but it has not fallen. It was founded on a rock.

As if to justify Smeaton's objection to wood as the material of the fabric, a portion of his work which was left unfinished and was of wood, caught fire in 1770, and was burned. It was replaced with stone, of which, when finally finished, the lighthouse was wholly built.

FLYING FISH.

FLYING FISH, or "sea-swallows," as they are also called, because of their resemblance to swallows in flight, are truly wonderful inhabitants of the deep. On first seeing them one might reasonably suppose them to be birds. There are three or four branches of the family, the more gaily decked being found only in the Mediterranean and Red Seas, while the common flying fish is met with all over the ocean within the tropics. Seldom or never does the little creature venture outside the warm water of the tropical seas, his delicate organisation rendering him unfit to brave the cold temperature either of north or south. In size the fish is about equal with the herring It is of a bluish brown colour at the top of the back, white on the belly, and yellowish red on the tip of the tail and of the fins. Its large pectoral fin stretches the length of its body, and is of a deep blue colour. The tail is forked, the lower bend being longer than the upper The head is scaly, and the whole body is squarish shaped. Some of the fish have four wings, others only two The fish clears the water by the aid of its tail, keeping its wings close till free of the brine; it then flies with a rapid motion till the wings become dry, which generally happens in the course of sixty yards. A touch of the water enables it to fly on about twenty yards further, and then the fish returns to the sea, exhausted. It does not rise more than six feet above the water, and seldom flies for more than a hundred yards.



FLYING FISH.

As regards the line of flight, some people profess to say that the fish fly against the wind. This may be so sometimes, but it is accidental; the fish fly just where they imagine they may get out of the way of bonitas, albacores, and dorados, their sworn foes, who seem to spend their whole time in hunting these unfortunate little creatures. Often it happens that, in their anxiety to get away from submarine enemies, they fall into destruction in the air; for sea-birds on the prowl know that the flying fish must come out, and wait for them accordingly, with all the patience of deer-stalkers.

The flying fish itself has not any teeth; its food, when time is allowed it to snatch a meal, consists of shrimps, infusoria, and the smaller kind of *medusa* But at best it must eat in haste, for the number of its destroyers is only equalled by their voracity Sometimes in their fright they will come on board ship, flapping down on the deck exhausted, and unable to rise again They have even been known to break the glass of the binnacle light, so great is the force with which they impel themselves Light seems to form a great attraction for them, and they will fly at night in crowds in the direction of a glare Advantage is taken of this known fact by the fishermen, who go out at night with nets rigged on poles sticking out all round the sides of the boat. When the fishing-ground has been reached, a fire is made in a brazier that is reared in the middle of the boat. Soon the moths of the sea are drawn to their destruction. They come, see, and are conquered, falling down helplessly entangled in the meshes of the net. The supply of them, especially in the Caribbean Sea, and around the West India islands, seems to be inexhaustible, and the demand for their bodies is commensurate with the supply.

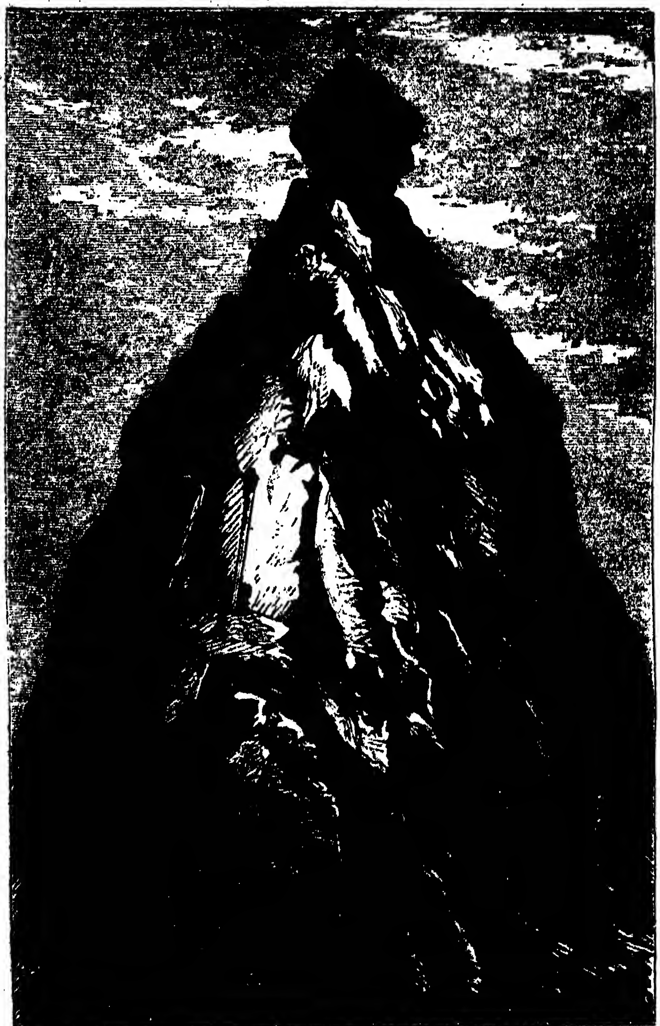
THE PETER BOTTE MOUNTAIN.

The Island of Mauritius, in the Indian Ocean, possesses a chain of mountains of volcanic origin, some of which are singularly striking and rugged in appearance. The most celebrated of these, and one that, from its peculiar formation, is one of the most wonderful mountains of the world, is known as the Pieter or Peter Botte, after the name of an adventurous Dutchman who, tradition asserts, once scaled its summit, but lost his life in coming down. In form it is a rugged cone, which runs up sharply from its base to the height of more than 2,800 feet; and at the summit of this cone is a huge mass of rock, which appears to be poised with the greatest nicety, so that a change in its direction of a few feet on either side would bring it to the earth.

The example of the unfortunate Dutchman was not sufficient to deter other daring spirits from making the same attempt, and several times in recent years the mountain has been ascended in safety. The first instance occurred in 1832, when a party of Englishmen accomplished what was then deemed a most daring and hazardous task. This party consisted of some officers of the Royal Navy and engineers, named Captain Lloyd, and Lieutenants Keppel, Philpotts, and Taylor. By the last named the narrative of their adventure was communicated to Sir John Barrow, and by him forwarded to the Royal Geographical Society. An idea of the difficulty of the undertaking, as well as the general character of the mountain, will be gained by the following extracts from Lieutenant Taylor's letter:—

"On rising to the shoulder of the mountain, a view burst upon us which quite defies my descriptive powers. We stood on a narrow ledge or neck of land about twenty yards in length.

"On the side which we mounted, we looked back into the deep wooded gorge we had passed up; while on the opposite side of the neck, which was between six and seven feet broad, the precipice went sheer down 1,500 feet to the plain. One extremity of the neck was equally precipitous, and the other was bounded by what to me was the most magnificent sight I ever saw. A narrow knife-like edge of rock, broken here and there by precipitous faces, ran up in a conical form to about 300 or 350 feet above us; and on the very pinnacle old "Peter Botte" frowned in all his glory.


THE PETER BOTTE MOUNTAIN.

"After a short rest we proceeded to work. A ladder had been left by Lloyd and Dawkins last year. [This was in a former and unsuccessful attempt by some of the same party.] It was about twelve feet high, and reached about halfway up a face of perpendicular rock. The foot, which was spiked, rested on a ledge, with barely three inches on each side. A negro of Lloyd's clambered from the top of the ladder, by the cleft in the face of the rock; he carried a small cord round his middle. A singl-

loose stone or false hold must have sent him down into the abyss; however, he fearlessly scrambled away, till at length we heard him halloo from under the neck, 'All right!' The line carried up he made fast above, and up it we all four 'shinned' in succession. It was, joking apart, awful work. In several places the ridge ran to an edge not a foot broad; and I could, as I held on half sitting, half kneeling across the ridge, have kicked my right shoe down to the plain on one side, and my left into the bottom of the ravine on the other. I held on *uncommonly hard*, and felt very well satisfied when I was safe under the neck.

"A communication being established with the shoulder by a double line of ropes, we proceeded to get up the necessary material—Lloyd's portable ladder, additional coils of rope, crowbars, &c. But now the question was how to get the ladder up against the rock. Lloyd made a line fast round his body, to which we all held on, and going to the edge of the precipice on the opposite side, he flung a large stone with a lead-line over the least projecting part, and it was eagerly seized on the opposite side. Three lengths of the ladder were put together on the ledge; a large line was attached to the one which was over the head, and carefully drawn up; and, finally, a two-inch rope, to the extremity of which we lashed the top of our ladder, then lowered it gently over the precipice till it hung perpendicularly, and was steadied by two negroes on the ridge below. 'All right, now hoist away!' And up went the ladder till the foot came to the edge of our ledge, where it was lashed in firmly to the neck. We then hauled away on the guy to steady it, and made it fast; a line was passed over by the lead-line to hold on, and up went Lloyd, screeching and hallooing, and we all three scrambled after him. The Union Jack and a boat-hook were passed up, and Old England's flag waved freely and gallantly on the redoubted Peter Botte."

The successful adventurers stayed all night on the summit of the mountain, and all descended safely in the morning.

The mountain was again ascended in 1848, in 1858, and lastly, so far as we are aware, in 1864, each time by a party of Englishmen. The details of the last ascent very much resembled those of the first, the same apparatus of ladders and ropes being employed to assist the adventurers. The traces of former ascents were discovered at the top, among them a piece of lead on which were inscribed the names of the mountaineers of 1848. A day or two after, the same party ascended the mountain again, and this time Mr. Greene, an amateur photographer, took several photographic views of the mountain, one of which has afforded the subject for our illustration. Before finally turning their backs upon Peter Botte they left their names in a "visitors' book," which was enclosed in a tin box and left on the top of the mountain, as a register for future adventurers.

ST. VITUS'S DANCE.

This peculiar disorder, now but rarely met with, was once widely prevalent in Germany and the Low Countries, where its diffusion appears to have been greatly encouraged by the fondness of the people for hysterical and superstitious excitement. The "dancing mania," as it has been called, was practised until a kind of general frenzy seemed to have seized the people, many of whom entirely lost control over their own motions. Jan, of Königshaven, an old German chronicler, thus describes the epidemic as it appeared at Strasburg—

"At Strasburg hundreds of folk began
To dance and leap, both maid and man
In open market, lane, or street,
They skipp'd along, nor cared to eat,
Until their plague had ceased to fright us—
'Twas call'd the dance of Holy Vitus."

The name appears to have been derived from the supposed power of St. Vitus over nervous and hysteric affections.

The pranks indulged in by persons afflicted with this mania were for some time ascribed to demoniacal possession. Even the great Paracelsus, who effected many cures by medicinal remedies, in which cold water was a prominent agent, for a time encouraged the popular belief, no doubt wishing in some cases to operate on his patients through the imagination. He therefore prescribed in these special instances that "the patient was to make an image of himself in wax or resin, and by an effort of thought to concentrate all his blasphemies and sins in it, without the intervention of any other person; to set his whole mind and thoughts concerning these oaths in the image; and when he had succeeded in this, he was to burn the image, so that not a particle of it should remain."

St. Vitus's dance, which raged in the countries we have mentioned from the fourteenth to the sixteenth century, began to decline as the progress of enlightenment calmed the minds of men, and freed them from their delusions. It is now only known as a form of disease which occurs chiefly among children, but is generally capable of successful treatment under proper conditions, while in many cases it is outgrown as the child advances in age.

DESTRUCTIVE POWERS OF WORMS.

In less than a year after a large jetty built at Valparaiso was finished, those piles which were not defended by copper were completely reduced to a honeycomb state by a curious little animal called the auger-worm (*Teredo navalis*), from the resem-

blance its head bears to a common auger. It is small, white, and almost gelatinous, with the exception of the head, which is armed with two movable plates of shell, by which it is presumed the animal perforates the wood. As it advances in the work of destruction it lengthens and increases in size by natural growth, constantly enlarging the cell in proportion to the demand for accommodation. The cell is lined with a calcareous coating (the secretion of the animal), similar to the shells of the molluscous tribes. The worm sometimes attains several feet in length, and an inch in diameter. From the havoc made on the jetty, it may be easily inferred what would be the fate of a vessel undefended by copper were she to remain long in this port.—*Three Years in the Pacific.*

THE STORY OF THE PORTLAND VASE.

"Bid mortality rejoice or mourn,
O'er the fine form of Portland's mystic urn."—*Darwin.*

FOR the space of five-and-thirty years there was deposited in the British Museum the most ancient glass vase in existence, an object of rare art, which for more than two centuries was the principal treasure of the Barberini Palace at Rome, and was subsequently known as "the Portland Vase." We remember this gem of art for many years in the old Museum. It was placed in the centre of the ante-room at the head of the stairs leading from the Gallery of Antiquities, upon an octagonal table beneath glass. The room was imperfectly lighted, and the vase was comparatively but little heeded by visitors to the Museum, but it has altogether a curious history. It was found about the middle of the sixteenth century enclosed in a marble sarcophagus, within a sepulchral chamber under the Monte del Grano, two miles and a half from Rome, on the road to Frascati. It was deposited in the palace of the Barberini family until 1770, when it was purchased by Byres, the antiquary, and sold by him to Sir William Hamilton, of whom it was bought for 1,800 guineas by the Duchess of Portland, who placed it in her museum at Priory Gardens, Whitehall; and on the dispersion of this museum by auction in 1786, this vase was bought in by the Portland family for £1,029. It is 9¾ inches in height, 7¼ inches diameter, and has two handles. It was subsequently deposited in the British Museum by the Duke of Portland in 1810.

On the vase being offered for sale by Sir William Hamilton, Wedgwood, "the father of the Potteries," considering that many persons, by whom the original was unattainable, might be willing to pay a handsome price for a good imitation of it, endeavoured to purchase the vase, and for some time continued to advance upon each bidding of the Duchess of Portland, until, at length, his motive being ascertained, he was offered the loan of the vase on condition of withdrawing his opposition. Consequently, the Duchess became the purchaser at the price of 1,800 guineas. It is stated that a limited number of copies were sold at 50 guineas each, and that the model cost 500 guineas; probably our greatest English sculptor, Flaxman, was the artist who was so liberally rewarded. Sir Joseph Banks and Sir Joshua Reynolds bore testimony to the excellent execution of these copies; they were chased by a steel tool, after the bas-relief had been wholly or partially fired. The vase was engraved by Cipriani and Bartolozzi in 1786. There is a copy of it in the British and Mediæval room, in the British Museum, and a mould of it was made by Pechler, the gem engraver, while it was in the possession of the Barberini family, and from this mould a number of casts were taken by ;, who afterwards destroyed the mould.

The vase is ornamented with white opaque figures in bas-relief upon a dark blue semi-transparent ground. The design, and more especially the execution, are truly admirable. The whole of the blue ground—or at least the part below the upper welding of the handle—was originally covered with white enamel, out of which the figures have been sculptured in the style of a cameo, with astonishing skill and labour. Although there cannot exist any doubt as to the materials of which this vase is composed, it is extraordinary that, notwithstanding four authors have agreed in considering it to be stone, all differ as to the kind of stone. Breval regarded it as chalcedony; Count Fetzi, amethyst; Bartoli, sardonyx; and De la Chausse, agate. "That travellers or authors," says Mr. Pellatt, "should have been so ignorant as to suppose that a natural production could have been hollowed out of the size of the Portland Vase, seems surpassing strange; nor does it appear less perplexing that each account should differ in the colour and description of stone."

There are three scenes on the vase; one on either side, and the other at the bottom. The first represents three exquisite figures seated under a tree near a ruined column. The centre figure, a female, is apparently greatly exhausted or dying; in her left hand she holds an inverted torch, while her right hand is thrown over her drooping head. On her right hand is the figure of a man, and on her left that of a woman, both seated, and looking towards the reclining figure. The other scene represents a male figure passing through a portal with great timidity, and descending into a darker region, where a beautiful female is waiting with outstretched hand to receive him. She is seated with her feet towards an aged male person, who is resting his chin on his hand, and has one foot raised on a column, and the other apparently sunk into the earth. Between the knees of the female is a large and playful serpent, and above is a Cupid,

who beckons the male figure to advance; and he is striving to take with him a cloak or garment, which adheres to the side of the portal. In this scene are two trees, shading the female and the aged male. On the bottom of the vase is represented another figure, pointing a finger to its mouth, and on its head is a Phrygian cap, and a broad-leaved tree above. Aged heads, satyr-like, are at the base of the handles.

The piece of bas-relief engraved glass forming the foot of the vase is distinct, and cemented to the bottom of the vessel; it appears to be of later date than the body of the vase, and by a different artist. It has likewise been conjectured that, the neck of the vase being small, the large opening at the bottom gave more room for putting in ashes or bones, prior to the foot being finally cemented on. At all events, this beautiful work of ancient art proves that the manufacture of glass was carried to a state of high perfection in early times.

On February the 7th, 1845, the vase was wantonly dashed to pieces with a stone by one William Lloyd, a visitor to the Museum. He was secured and taken before a police magistrate, who fined him £3 for destroying the glass shade, which belonged to the trustees of the Museum: the fine was paid by some anonymous person. The broken pieces of the vase were gathered up, and it has been restored by Mr. Doubleday so beautifully that a blemish can scarcely be detected. A drawing of the fractured pieces is preserved. The vase is now kept in the model-room at the Museum.

Wonderful Fishes.

GRATITUDE IN A PIKE.

WHEN the late Dr. Warwick resided at Durham, the seat of the Earl of Stamford and Warrington, he was walking one evening in the park, and came to a pond where fish intended for the table were temporarily kept. He took particular notice of a fine pike, of about six pounds weight, which, when it observed him, darted hastily away. In so doing it struck its head against a tenter-hook in a post (of which there were several in the pond, placed to prevent poaching), and as it afterwards appeared, fractured its skull and turned the optic nerve on one side. The anguish evinced by the animal appeared most horrible. It rushed to the bottom, and boring its head into the mud, whirled itself round with such velocity, that it was almost lost to sight for a short interval. It then plunged about the pond, and at length threw itself completely out of the water on to the bank. The doctor went and examined it, and found that a very small portion of the brain was protruding from the fracture in the skull. He carefully replaced this, and with a small silver toothpick, raised the indented portion of the skull. The fish remained still for a short time, and he then put it again into the pond. It appeared at first a good deal relieved, but in a few minutes it again darted and plunged about until it threw itself out of the water a second time. A second time Dr. Warwick did what he could to relieve it, and again put it into the water. It continued for several times to throw itself out of the pond, and with the assistance of the keeper, the doctor at length made a kind of pillow for the fish, which was then left in the pond to its fate. Upon making his appearance at the pond on the following morning, the pike came towards him to the edge of the water and actually laid its head upon his foot. The doctor thought this most extraordinary; but he examined the fish's skull and found it going on all right. He then walked backwards and forwards along the edge of the pond for some time, and the fish continued to swim up and down, turning whenever he turned; but being blind on the wounded side of its skull, it always appeared agitated when it had that side towards the bank, as it could not then see its benefactor. On the next day he took some young friends down to see the fish, which came to him as before, and at length he actually taught the pike to come to him at his whistle and feed out of his hands. With other persons it continued as shy as fish usually are. Dr. Warwick thought this a most remarkable instance of gratitude in a fish for a benefit received; and as it always came to his whistle, it also proved what he had previously disbelieved, that fishes are sensible to sound.

VOICE OF THE TENCH.—Dr. Shirley Palmer relates the following singular fact:—"In the spring of 1823 I received from a friend a brace of tench just taken from the water. They were deposited in a dish and placed upon a high shelf in the larder, situated between the dining parlour and cooking kitchen. The following midnight, whilst writing in the dining-room, my attention was excited by a deep, hollow, protracted groan. It was twice or thrice repeated, and all my efforts to discover the source of the sound were ineffectual. At length my ear was startled by a loud splash, succeeded by a groan more deep and long-continued than those which I had previously heard, and evidently proceeding from the larder. Inspection of that room explained the mystery. One of the fishes had sprung down from the shelf on the stone floor, and there lay, with mouth open, and pectoral and ventral fins extended, uttering the sounds by which my midnight labours had been interrupted. Next day both fishes were cooked for dinner; and such is the tenacity of life in the tench, that although thirty hours had then elapsed since their removal from their native element, both fishes, after having undergone the process of scaling and evisceration, sprang vigorously from the pot of hot water when consigned to it by the cook."

LANDSCAPE IN TROPICAL AFRICA, WITH SPECIMENS OF WELWITSCHIA MIRABILIS.

Wonders of Vegetation.

THE WELWITSCHIA, THE WONDERFUL TABLE-TREE OF WESTERN AFRICA.

ABOUT 1000 miles north from the Cape of Good Hope, on the western side of Africa, there is an extensive district of sterile country extending northwards to the Portuguese settlement of Benguela. This region is almost, if not altogether, rainless. Heavy dews fall at night, and supply the little moisture required by the scanty vegetation, which consists of a few plants, specially fitted by their organisation to endure the continuous rays of a tropical sun poured down from a cloudless sky. The exposure of one of our English plants to such a sun for even a few minutes would evaporate every particle of moisture it contained, and wither it up into a dead, dry, friable skeleton. But these strange plants, from the great thickness of the skin which covers their leaves, and the structure of the stomates, are able to resist the action of the most powerful rays of the sun, and to retain the little moisture they require for the necessities of their life.

Among the few plants scattered over these arid sandy plains is one which its describer has properly called *mirabilis*, as it is one of the most wonderful plants anywhere to be found on the surface of the earth. It was discovered in the year 1860 by the eminent scientific traveller, Dr. Welwitsch, whose name has been associated with it by Dr. Hooker in commemoration of his successful botanical explorations in Central Africa.

The Welwitschia is a tree which lives for many years, some specimens being estimated by their discoverer as at least a hundred years old, and which every year of its life increases in size, yet never grows higher. Rising just above the ground, this strange plant, looking like a rough roundish table, regularly enlarges by adding concentric layers to its circumference. The flat upper surface of the trunk is very hard and dark, resembling in colour and texture the crust of an over-baked loaf. In shape it is a somewhat compressed disc, with a more or less deep groove running through the centre of its longest diameter, and dividing it into two lobes. It is marked with a number of concentric ridges studded with circular pits which have been produced by the fallen fruit-stalks. Each new ridge or concentric layer supports a large number of fruits, in the form of beautifully regular and bright scarlet cones, somewhat resembling the fruits of the fir-trees of our forests, to which trees the Welwitschia, though so different in aspect, has a very close affinity. Sometimes, in old plants, the margins of the lobes are very much split. The trunk attains a size of from fourteen to eighteen feet in circumference, but is never more than a few inches above the ground. It gradually tapers downwards, forming a large tap-root, which penetrates several feet into the ground.

When the young plant springs from the seed, it sends up two small green leaves corresponding to the first seed-leaves of the oak or beech. But in our trees, and in all other plants, these first leaves, having performed their part in the growth of the plant, decay and disappear, and are succeeded by numerous others of shapes peculiar to the different plants to which they belong. The Welwitschia is a singular and remarkable exception to this otherwise universal rule. It never loses its two first leaves, and it never gets any more. Imagine a frog always remaining in its tadpole state, with external gills, a long swimming tail, and no legs, yet growing to the size of a large frog. Such a creature would be in the animal kingdom as great an anomaly as the Welwitschia is in the vegetable kingdom. The plant is really an infant tree, attaining the age of a hundred years, yet never getting rid of its early imperfect condition. The leaves rise from two deep grooves in the outer margin of the trunk, one springing from each lobe. They increase in size year after year with the growth of the plant until, in the larger specimens, they attain a length of six feet or even more. They are quite flat, long, very leathery, and frequently split into numerous straps, that lie curling upon the surface of the barren soil.

A less inviting landscape can scarcely be imagined than the sandy desert sparsely covered with short dry grass and scattered specimens of this extraordinary plant, looking more like the remains of some ancient forest which had been cleared by the axe of the settler, than a collection of complete and living plants. For a time, when they are in perfection, the short branches of bright scarlet cones which cover the crown of the stem relieve the dismal monotony. With all its strange peculiarities—and, indeed, chiefly because of them—the Welwitschia is singularly adapted to the physical conditions under which it lives.

INVENTION OF THE ARCH.

The invention of the true arch, after much controversy, has been satisfactorily traced to the early Egyptians. Mr. Fergusson, in his valuable "Handbook of Architecture," observes: "It is generally supposed that the early Egyptians were ignorant of the true principles of the arch, and only employed two stones, meeting one another at a certain angle in the centre, when they wished to cover a larger space than could conveniently be done by a single block. This, however, seems to be a mistake, as many of the tombs and chambers around the Pyramids are roofed by stone arches of a semicircular form, and perfect in every respect as far as the principles of the arch are concerned."

Several of these semicircular arches have been drawn by Lepsius, but as their date cannot be ascertained, Mr. Fergusson considers that the curved form of the roofs of the third Pyramid would alone be sufficient to render it more than probable that during the period of the fourth dynasty the Egyptians were familiar with this expedient. "At Beni Hassan, during the time of the twelfth dynasty, curvilinear forms appear in the roofs, used in such a manner as to render it almost certain that they are copies from roofs of construction. Behind the Rhamassion, at Thebes, there is a series of arches in brick which seem undoubtedly to belong to the same age as the building itself; and Sir Gardner Wilkinson mentions a tomb at Thebes the roof of which is vaulted with bricks, and still bears the name of Amenoph I., of the eighteenth dynasty, or 1500 years B.C.

"In Ethiopia, Mr. Hoskins found stone arches vaulting the roofs of the porches of the Pyramids, perfect in construction, and—what is still more singular—showing both circular and pointed forms. These are not earlier than the age of Solomon, nor later than that of Cambyses."

In the age of Psammeticus, about 600 B.C., we have several stone arches in the neighbourhood of the Pyramids. One, in a tomb at Sacca, has frequently been drawn; but Captain Campbell discovered an arch of a more primitive form, composed of three stones only, and above that another arch of regular construction of four courses. Layard discovered at Nimroud, vaulted drains and chambers, circular and pointed, below the north-west and south-east edifices, and consequently as old as the eighth or ninth century before our era.

The great discovery of this class, however, is that of the city gates at Khursabad, which were spanned by arches of semicircular form, so perfect as to prove that in the time of Sargon the arch was a usual and well-understood building expedient.

Mr. Fergusson also infers, from discoveries made, that the Assyrians used the pointed arch for tunnels, aqueducts, and generally for underground work where the pressure was great, and the round arch above ground.

In Europe, the oldest work is probably that of the Cloaca Maxima, at Rome, constructed under the early kings. It is of stone, in three rims, and shows as perfect a knowledge of the principle as any subsequent example.

From all this, says Mr. Fergusson, it becomes certain that the arch was used as early as the times of the Pyramid builders of the fourth dynasty, and was copied in the tombs of Beni Hassan, of the twelfth; and although the earliest existing example cannot be dated further back than the first kings of the eighteenth dynasty from that time, that the arch was currently used, not only in Egypt, but also in Ethiopia and Assyria.

The old notion that the pointed arch originated in the intersection of two round Norman arches, or

in groined vaults, can no longer be held, as both were unknown till long after the pointed arch had been common in the East. "A whole mosque," says Sir J. Gardner Wilkinson, "still remains at Cairo, built A.D. 879; the Cufic inscriptions at the Nilometer of Roda, opposite Old Cairo, show from their style that its pointed arches are of a similarly remote period; and there is reason to believe that this kind of arch was used by the Arabs long before. It is also found covering one of the chambers before an Ethiopian pyramid at Gebel Bérkel, built while the Romans were in Egypt. There is one with a keystone over a passage at Tusculum, at least as old as the days of the Latin Confederation; another at Pompeii, at Zindem, and at Ephesus; and future discoveries will doubtless prove that it was employed in the East before its adoption by the Saracens."

"If not its inventors," continues the same authority, "the Saracens were the first to make known the pointed arch to the architects of Europe; and the builders of the thirteenth and fourteenth centuries benefited, like their predecessors, by the hints derived from those of other people, which were adopted and made their own, without derogating from the excellence of the new style, and without their builders thinking themselves degraded by adopting what was beautiful and suited to their wants. This was adaptation, not mere imitation."

THE BUTTER BIRD.

HUMBOLDT, in his "Travels in South America," records a visit to Caripe, where is the cavern of the Guacharo bird; and our knowledge of this wonder is derived from his most interesting narrative. Among the natives in the country around, this cavern is celebrated for its great size, for the mysterious birds which haunt its inmost recesses, for the river which flows from it, and for the superstitious belief that in its gloomy depths is the abode of the spirits of their departed ancestors. The name which it bears signifies "the mine of fat," because from the young of the birds which inhabit it an immense quantity of fat is annually obtained. These birds are about the size of our common fowl, with wings which expand to three feet and a half. All day long they dwell in the cavern, and, like our owls, only come forth at night. They subsist entirely on fruits, and have very powerful beaks, which are necessary to crack the tough nuts and reeds which form part of their food.

The approach to the cavern where they are found is along the bed of a river, in a valley celebrated for its beauty and the salubrity of its climate. The immediate entrance is surrounded by the most gorgeous tropical vegetation. The hill, into the depths of which it penetrates for upwards of half a mile, is clothed with trees of immense height. The mouth is a splendid arch upwards of seventy feet high; the river which flows from it has a fringe of vegetation along its banks, which gradually diminishes as the gloom increases.

The cave is so straight that the traveller can enter for some distance without being obliged to light his torch. As he proceeds over the somewhat rough ground which forms the bed of the river, he begins to hear from afar the hoarse cries of the Guacharo birds; and when he has arrived at the dark parts of the cavern the noise is perfectly terrific; thousands of the birds uttering their piercing cries simultaneously. These screams re-echo from the surrounding walls, and when it is remembered that they take place in pitchy darkness, it will be easy to understand the superstitious terrors which the Indians associate with the spot. At half a mile from the entrance the river forms a cascade, and beyond this the cavern slightly changes in direction. Nothing will persuade the Indians to advance further than this spot.

Midsummer is the harvest time for the fat. The Indians enter the cave armed with long poles. The nests are attached to holes in the roof about sixty feet above their heads. They break these with the poles, and the young birds fall down and are instantly killed. Underneath their bodies is a layer of fat, which is cut off, and is the object sought. At the mouth of the cavern huts are erected with palm-leaves, and there, in pots of clay, the natives melt the fat which has been collected.

This is known as the butter of the Guacharo; it is so pure that it may be kept for upwards of a year without becoming rancid. At the convent of Caripe no other oil is ever used in the kitchen of the monks.

THE WONDERS OF LIGHT.

THE mere fact that light is the motion of an ethereal fluid is astonishing, but the way in which the theory is supported by observation is even still more remarkable.

Let us take an example from what is called "Interference." If the reader will throw two stones into a pond, and carefully observe the circles of waves as they mingle with each other, it will be found that when the crest of one wave happens to be in the trough of the one coming to meet it, there will at that place be a level.

This will at once be evident by a glance at the diagram with which we illustrated our late notice of this subject. Remembering how minute these bends are—50,000 of them only making one inch in length—it will be very evident that to all intents and purposes the waves will be obliterated. But if, as we have asserted, light is nothing but the impulse of these waves, surely, if we annihilate the waves, we destroy the light. Can this be done? A moment's thought

will at once convince us that if we had two waves of light, and were able to allow one to have the start of the other by just half the length of a wave, we should then place these waves in the very position required, and be able to demonstrate the rather startling wonder that two waves of light, under these circumstances, produce, not more light, but absolutely darkness! Any of our readers can perform the experiment, and thus be assured of one of the most beautiful confirmations of this most wonderful theory. It is only requisite to be provided with two pieces of glass, one of which must be curved—a magnifying glass, or spectacle glass, or even a tumbler will suffice. The curved surface is placed on the flat piece of glass, and whilst in this position they are so held as to permit light from the window or any other source to be reflected into the eye from the point at which they touch; and at that point will be found a spot of darkness—where there is no light—and on carefully observing, this centre spot will be surrounded by dark rings. This is explained by referring to Fig. 1. The ray of light, S B, penetrates the curved glass, arriving at its under surface at A; some of it is reflected upwards in the direction A E, some of it passes on, and arrives at the surface of the second piece of glass. Here it behaves precisely in the same way as at A; some passes on through the glass, the rest is thrown upwards or reflected in the direction B F. Now, it is very evident that the two rays of light, when they enter the eye at E F, have not travelled an equal distance; for the light which journeyed along the path S B F, had further to go than the other, and if it so happened that this distance was greater by the length of half a wave—that is, if the one path were $\frac{1}{100000}$th of an inch longer than the other—then the two waves would interfere, and destroy each other. This phenomenon would take place, of course, if the one path were longer than the other by any quantity which contained half a wave length, 1½, or 2½, or 3½, &c., and at these distances the rings appear. This phenomenon has also an illustration in the case of sound. As we said before, the sensation of sound is produced by waves of air beating upon a very fine membrane or skin, which is stretched across the tube which has its opening in the orifice of the ear. Different sounds are caused, just as colour in light, by the rapidity of the vibration of these waves. For instance, whenever the note middle C is struck, it causes the tympanum, or the fine membrane in the ear, to be struck 256 times in a second; if an octave higher, double this number, or 512 vibrations are produced. This is easily proved by causing a cog-wheel (Fig. 2) to turn rapidly, holding a card, A, against the teeth; when 256 teeth of the wheel hit against the card in a second, the note C is produced.

Fig. 1.

A tuning-fork causes the air to vibrate, and if it be held a little from the ear, and gradually turned round, the strength of the note will vary greatly: now it is scarcely audible, now it is loud; the reason being that as the fork is turned, the waves from each prong are brought exactly into the same position as those of light in the instance cited—they interfere, producing silence. This accounts for the beats—the pulses in a sound—which are very marked when two adjacent bass notes of a harmonium are held down together.

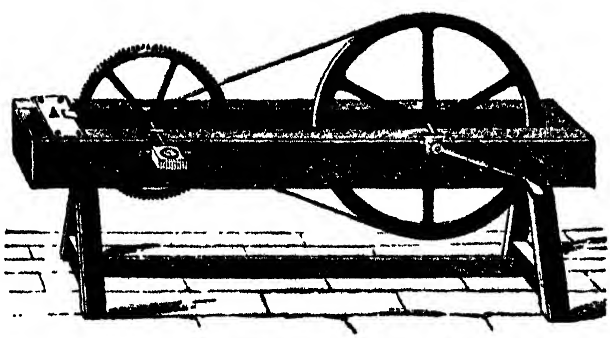


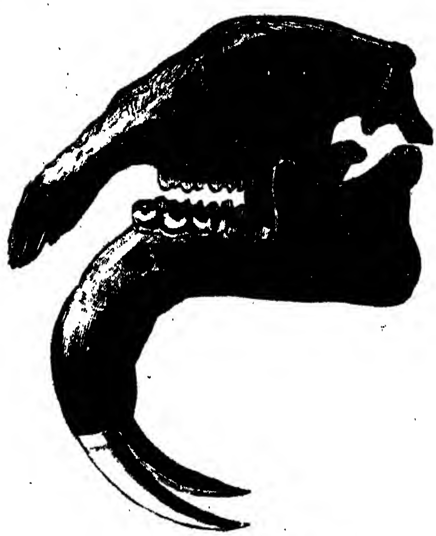
Fig. 2.

Returning to light for a moment, this explained wonder gives us the reason why a mother-of-pearl shell should show a play of colours.

The waves of coloured light are not of the same length; the wave of red light is $\frac{1}{34000}$th of an inch, whilst that of violet is $\frac{1}{60000}$th. Now, it is very evident that sometimes it may so happen that the red rays of two pencils of light may extinguish each other; and if you take away red out of white light, you leave the yellow and blue, which make green. So the blue might be taken out, and the light would then be orange. A mother-of-pearl shell is made of very fine layers; and the light from the edges of these layers is reflected. The rays interfering with each other annihilate some colours, making the white light coloured. If a piece of white wax be pressed upon such a shell, the wax takes the impress of the layers, and exhibits this wonderful phenomenon. The colours of a soap-bubble, and all such thin films, are due to this wonder of interference.

THE DINOTHERIUM.

SOME years ago a huge head was dug up by some workmen at Epplesheim, in Germany. The bones were all that was left, but their wonderful size attracted attention at once. As the digging proceeded, two immense tusks were found to be attached to the lower jaw-bone, close to the chin; they did not simply project like the tusks of an elephant, but were curved under the jaw. Their position was so peculiar, that it left the notion on the mind that if the animal ever opened its mouth very wide, or fell on the top of its head, the points of the tusks would pierce either its neck or chest. Some scientific men cleaned this great skull and placed it in the museum of Darmstadt. Drawings and models were made of it, and for many years it was the wonder of the place. It became an object of great interest to all the anatomists of the day, who differed greatly in their opinions concerning the habits of the animal to which it once belonged. A model of the skull was once in the British Museum, but now the real head has been purchased for several hundred pounds, and it may be recognised at once by the curiously-curved tusks of the lower jaw. When this skull is compared with those of some of the elephants, it will be found very much larger than any of them; and on looking at the front, some resemblance will be noticed between the faces of the two animals. Like the elephant, the former possessor of the great skull had a flexible nose in the form of a trunk. The openings for the eyes are large, and for the ears also, and the teeth still remaining in the jaws are enormous and very heavy, and are ridged so as to form two gable-looking tops to their chewing surface. The head resembles that of an elephant without tusks, and also that of an animal which lives in America called the tapir. The tapir is in appearance something between a pony and a pig with a very long snout; but it has not the great curved tusks which are placed in the lower jaw of this wonderful skull. There could be no doubt that the animal whose skull was thus attracting so much attention was a quadruped; but at first its huge bulk was thought to be too great for that of a land animal; for, from its head being so large, it was supposed to have a correspondingly large body. Consequently it was placed amongst the whale kind. After the lapse of a few years, some pieces of the head-bones and limb-bones of the animal were found in the south of France, and also on an island in the Arabian Sea. These bones were like those of enormous elephants, and the idea of the creature being a whale was abandoned. It was called Deinotherium, or Dinotherium, which means in Greek *awful beast:* awful from its size only, for its teeth were so made that they could not tear flesh, and the great tusks were so curved that they could never hurt any other animal than that which possessed them. Probably the Dinotherium stood as high as the tallest elephant. It had rather a long neck; its forehead and face did not look to the front like those of an elephant, but upwards, like those of the hippopotamus. The trunk, probably, was not long, and the lower lips were very large.



SKULL OF THE DINOTHERIUM.

This wonderful beast was a feeder upon vegetables and not upon animals; its curved tusks enabled it to dig up roots, and its trunk plucked rushes, large grasses, and twigs, all of which the huge grinders could pound into a pulp, to be swallowed easily enough. Some anatomists think that the Dinotherium was a river beast, and that it lived in streams and lakes, fixing itself to the banks by means of its tusks when it wished to cease floating about, just as the great walrus anchors itself on the ice. Others consider that it lived very much like the elephants do now; but most probably it was a slow-moving creature, with a prodigious appetite for sweet canes, soft young twigs of growing trees, and wild roots.

As the bones of the Dinotherium were found in the west of Europe and in Asia, it must have lived over a great extent of country. The tusks in the lower jaw had to be moved up and down with the jaw every time the mouth was opened and shut, and therefore their great weight must have been wearisome to the animal unless the muscles which governed this motion were very large and strong. That they were so, the space in which they worked in the skull proves: there was a muscle on each side as thick as the body of a man! It is wonderful that this great beast should no longer exist, and that there is no animal with tusks like it. The Dinotherium died off from the face of the earth before man was created, and it is the most wonderful of the many beasts that inhabited the world which was gradually being prepared for us.

Wonders of Vegetation.

The Lemon Grass of Ceylon.—One of the most remarkable productions of Ceylon, which is believed to be peculiar to that island, is the lemon grass, known to botanists as *Andropogon schœnanthus.* This curious herb is celebrated not only for its distinguishing properties, but for the conflagrations of which it is frequently the subject. It may be seen covering almost all the Kandian hills, and while it is young is the best possible pasture for cattle. It grows to the height of seven feet or more, is very hard to the touch, and has a strong but very pleasant acid taste. It derives its name from having, when crushed, an odour like that of a lemon, so strong that after a time it becomes quite heavy and sickening, although grateful and refreshing at first. It covers the hills in patches wherever they are not overgrown with jungle, and is to be found nowhere but in the Kandian district. It frequently ignites spontaneously, and the appearance of the burning grass is described as most magnificent. On the slopes of the mountain of Ambulawe, in the wet season, the grand spectacle of the conflagration is frequently to be seen. Flames burst from spot to spot till they unite and become one lurid mass, which continues burning rapidly against the wind, the long grass being bent by the breeze towards the flames. When the conflagration is at its height it throws a fierce glare all around, and the growling hollow sound made by the roar of the flames is heard at a very great distance. When it has by degrees subsided, volumes of dense smoke roll upwards, sending forth millions of sparks, which, falling on whatever grass may be remaining, frequently cause a second conflagration to arise. A few days after, from the midst of this parched, and blackened, and apparently dead ground, lovely young green shoots begin to arise—for the roots of the grass have not been injured, far less destroyed by the fire—and in a very short time the whole brow of the mountain is again overspread with tufts of beautiful waving green.

The Castle Trees of South Africa.—About the latitude 23 deg. S., the traveller will first meet with the gigantic and castle-like Uwana, which is decidedly the most striking and wonderful tree among the thousands which adorn the South African forests. It is chiefly remarkable on account of its extraordinary size, actually resembling a castle or tower more than a forest-tree. Throughout the country of Bamangwato the average circumference of these trees was from 30 to 40 feet; but on continuing my researches in a north-easterly direction throughout the more fertile forests, which clothe the boundless tracts through which the fair Limpopo winds, I daily met with specimens of this extraordinary tree averaging from 60 to 100 feet in circumference, and maintaining this thickness to a height of from twenty to thirty feet, when they diverge into numerous goodly branches, whose general character is abrupt and horizontal, and which seem to terminate with a peculiar suddenness. The wood of this tree is soft and utterly unserviceable. The shape of the leaf is similar to that of the sycamore tree, but its texture partakes more of the fig-leaf; its fruit is a nut, which in size and shape resembles the egg of the swan. A remarkable fact in connection with these trees is the manner in which they are disposed throughout the forest. They are found standing singly, or in rows invariably at considerable distances from one another, as if planted by the hand of man, and from their wondrous size and unusual height (for they always tower high above their surrounding compeers), they convey the idea of being strangers or interlopers on the ground they occupy.—*Cumming's "Five Years in the Interior of South Africa."*

LEECHES ATTACKING TRAVELLERS.

Of all the plagues detested by travellers, the land leeches of Ceylon are the worst. They exist in thousands, and though not visible when the weather is hot and dry, a smart shower brings them out of their lurking-places, and they lie in wait for the first passer-by with all the cunning of brigands. Sir Emerson Tennant describes them as being about an inch in length, and as fine as a common knitting-needle; yet they are capable of distension till they equal a quill in thickness, and attain a length of nearly two inches. They have the power of planting one extremity on the earth, as if it were held down by a sucker, while the head is raised to watch for their victims. On descrying their prey, they advance by semicircular strides. Fixing their mouths on the ground, they move forward their tails, and so proceed mouth and tail alternately with the greatest rapidity until they lay hold of the traveller's foot, and ascend his dress in search of an aperture by which to enter. They are so flexible that they can insinuate themselves through the meshes of the finest stocking, and when they once reach the skin they ascend even to the back and throat, and fasten on the tenderest parts of the body. In these encounters the individuals in the rear of a party of travellers are sure to fare worst, as the leeches, once warned of their victims' approach, congregate with wonderful celerity. Their size is so insignificant, and the wound they make so skilfully punctured, that both are generally imperceptible; and the first intimation of their onslaught is the trickling of the blood, or the chill feeling caused by the leech when it begins to hang heavily on the skin from being distended by its repast. Horses are driven wild by them, and stamp the

ground with fury to shake them from their fetlocks, to which they hang in bloody tassels. Sir Emerson declares that he has also seen them hang like bunches of grapes round the ankles of palanquin bearers and coolies, who, however, suffer no other inconvenience than the annoyance caused by the inflammation and itching of the wounds. The best cure is to rub the part with lemon-juice. These creatures are not confined to Ceylon, but are known also in the lower ranges of the Himalayas, and in Batavia, Sumatra, Japan, and Chili. The Ceylon species have five pairs of eyes, and their bodies are formed of one hundred rings. Their teeth are very beautiful, and amount to seventy or eighty in each set.

A GRAIN OF SAND.

In Connemara, in the west of Ireland, there is a large bank of sand, bordering a small bay known by the name of Dog's Bay. By naturalists all over the kingdom specimens of this sand are eagerly sought. In appearance it does not differ much from ordinary sand, but when examined under the microscope a most wonderful and beautiful appearance is presented. Amid the grains of sand which accompany them, there are countless thousands of most exquisitely beautiful shells. These shells are about the size of the head of the smallest pin made, and they are not equalled in beauty by any of the well-known sea-shells. The variety of their forms, and the incredibly great number of each kind, at once attract our attention. Here we see one shaped like a minute oil-flask, the substance of which it is made being of a pearly whiteness, and so thin as to be almost transparent. Along the outside of the little flask from the mouth to the bottom run delicate ribs, and the whole surface is dotted over with innumerable small holes. Another very common kind resembles a number of beads, gradually increasing in size, strung together, the outside of these beads having the usual delicate ribs and the almost invariable minute holes. Another form, perhaps the most common of all, closely resembles the nautilus in miniature; these are only samples taken from hundreds of others equally beautiful and interesting. What do we know about the creatures which tenanted these frail habitations? These shells are all empty, but in the sea they live and move. Naturalists have collected and examined them, and they find within each tiny shell a small bit of jelly. There is no distinction between head and heart, between mouth and stomach. The animal is simply a bit of jelly fitted into a beautiful shell. But how does he live? From the small holes which perforate his house long arms of jelly come out. Swaying about in the sea they touch some smaller animal—some tiny animalcula—or they enwrap some minute floating plant, and draw it into their substance, and thus derive their sustenance. These shells always grow in the sea; those found on the beach when alive have been just thrown up from the sea. At depths where no other animal could possibly exist, there these little creatures live and flourish.

Sounding-lines sent down two or three miles to the bottom of the Atlantic Ocean, having a little grease attached to the weight, bring us samples of that which lies there, and among these samples there are to be found myriads of the little shells. It has been mentioned that the outside of the shell is marked with holes; this the name of the animal signifies—*Foraminifera.* They are called Foraminifera, or *bearers* of *holes*, from the Latin words, *foramen*, a hole, and *fero*, I carry.

THE DISINTERRED POMPEIANS.

For the tourist it is no long and arduous journey before he can stand in reality amid the courts of Pompeii; while in imagination he can recall the dread scene when, amid the darkness of that awful time, the snowy ashes began to fall, mingled with masses of pumice-stone of a size sufficient to crush through roofs, or, striking together in the air, to break in showers of fire, dealing destruction to those within their reach. Suffocating heat, deadly sulphurous fumes, falling fiery fragments, the rush of molten lava, the rumbling of the earthquake, and the hideous roar of the mountain in its fearful throes, all were there; and in their mortal dread, shrieking with fear, the inhabitants tried to escape with their treasures, but if not to fall suffocated and beaten down in the streets, to retreat to their houses, seeking even in the cellars for safety.

No legend, this; for in laying open once more to the day the city of Pompeii, the last acts of many of its inhabitants were discovered, the liquid mud having taken casts of the bodies—casts that have hardened, and remain to show us the form, features, even the dress, of those people of the past. Here, a skeleton is found embedded in the ashes of a lower room, with arms raised to defend the head from the floor of the chamber above, crushed down by the weight of the accumulating ashes; there, forms of men, women, children, even infants, have been disinterred, and by the light thus afforded the history of their fate and struggles can be read. At one villa the spade laid bare the skeleton of a man with a key close to a gate, and by him a treasure in money that he was evidently bearing away; while stretched beside him lay another figure, with a number of silver vases: possibly the master and slave seeking safety, when beaten down or suffocated by the fiery fumes. But, as the strong sought safety in flight, the weak trusted to the walls for protection.

and then fled to the vaults beneath the house; for here, after being buried seventeen ages, were discovered twenty figures—eighteen of them being those of full-grown persons—buried in wonderfully fine ashes, that had gradually forced their way in through chink and cranny, and afterwards to form round them, taking the casts of the bodies with a wondrous fidelity, and hardening into a firm mass before the dead gradually decayed or dried up into a frame-work of calcined bones.

In endless cases the last acts seem to have been to try and save treasure, for by skeletons innumerable were found collected together in room or vault, or thrown down in despair on pavements, or in street, documents and precious stones, engraved gems, rich vases, bracelets of gold, of great weight and marvellously beautiful manufacture.

Room after room—atrium, triclinium, &c.—are pointed out where skeletons were discovered; while in one part five were found together in an upright position, as if suffocated or buried subsequently when searching for the hidden treasures of the city. But it was not till quite lately that an idea occurred to an Italian gentleman, while superintending the excavations, of getting a more perfect record of the history of the dead citizens. He had seen the shovel of the labourer sink into some cavity in the consolidated ashes, to find that in many cases here had been the body of some unfortunate gradually desiccated, but leaving its shape in the surrounding earth. Upon the next discovery of such a cavity, he had it carefully filled with liquid plaster, left it to solidify, and then the hardened ashes were broken away, with the result that he had hoped for; since here, in the attitude taken at that awful time, was the casting of the dead Pompeian, with feature, form, everything exact: in one case, evidently an elderly woman who had lain down quietly to die; in another, a fair young girl convulsed with horror, her limbs contorted, and her dress or veil held round her head to keep out the suffocating ashes—rings, ornaments, all plainly to be seen; and even the embroidered sandals upon the feet of one figure, whose coarsely-textured dress and many rents seem to indicate that she belonged to the poorer classes. The folds of her head-dress can be seen sweeping down upon her shoulders, to join the gracefully hanging robe; but her appearance is distressing in the extreme. Evidently fleeing for her life with what few treasures she could collect—jewels, silver coins, silver cups, and the key that probably had been used to secure others—she had fallen at last, overcome by the suffocating heat and deadly gases floating around. But the next figure displays the peaceful sleep of the strong—a tall, stout man this, lying upon his back with calmly extended limbs, one who was probably overcome at once by the stifling fumes. In this case the clothing of a man of his station is plainly to be made out, and he was evidently of the humbler classes, as shown by his iron ring and heavy, nail-studded sandals lightly laced to his ankles. His dress was a short tunic, and here it seems that the heat of the falling ashes was not so intense, for a portion of the man's moustache is to be seen upon the casting, while some of the teeth are yet entire.

Many of the bodies seem to have been buried, not by the falling ashes, which were so heated as in most cases to directly calcine wood, but by the finer soft dust, that gradually worked its way through to where they had crouched for protection—a fact which accounts for the delicacy of the moulds formed by time. At the present time the number of skeletons discovered is about seven hundred. The first disinterment was made in 1748, but of late years the excavations have been carried on more extensively; and fresh wonders of the by-gone civilisation, as well as new horrors of the awful catastrophe, are daily brought to light, when the imagination easily supplies the little wanting to complete the scenes of this awful drama, giving life to the castings, clothing the carbonised skeletons with flesh, and seeing again their dread fight for life against falling cinders, blinding ashes, and deadly fumes.

A city of wonders! but admiration for the beauties displayed in the various mansions and public buildings soon gives place to a feeling of dread, almost of awe, as the visitor gazes upon the remains of those disinterred from their ashy bed.

THE COLUMN OF TRAJAN.

THE column of Trajan, erected by that emperor as a decoration to his great Forum, is the finest in the world, and is one of the most perfect works of ancient art that time has spared, it being, with few exceptions, in a high state of preservation. The spot which it occupies was originally cut out of a spur or offshoot of the Quirinal Hill, down to the level of the rest of the Forum, and the height of the column is exactly the same as that portion of the hill which was removed, as stated in the Latin inscription on the pedestal. From this inscription we learn that the monument was erected by the Senate and people of Rome, not only to commemorate the victories of Trajan over the Dacians, but also as a memorial of the height of the hill which it was necessary to cut away in order to make room for the noble structures which adorned the Forum. This height is 128 modern feet, exclusive of the bronze statue of St. Peter, eleven or twelve feet high, on its summit, which was placed there by Pope Sixtus V., in the latter part of the sixteenth century, instead of the statue of bronze gilt which had formerly occupied the top, but which had long

previously disappeared. The entire shaft of the column is composed of twenty-three blocks of Grecian marble, so curiously cemented as to seem but one. The base and the pedestal have nine blocks, the capital one, and the basement of the statue one,—making thirty-four blocks of marble in all. The ascent is by a winding staircase of 185 solid steps of Parian marble, lighted by loopholes.

The column is admirable both for its proportions and for the design and execution of the bas-reliefs and ornaments, which completely cover it. The bas-reliefs ascend in a spiral band, so as not to destroy the line of the shaft by their projection, as in the column of Marcus Aurelius, called the Antonine Column. The whole pillar is encased with sculptures, representing the exploits of Trajan and his army, particularly his triumph over Dacia after fifteen years' war. These sculptures represent pictorially the progress of Trajan's campaign, and are full of details connected with the mode in which the Romans were wont to carry on war; while the representations of the armour and habits of the Romans in the field of battle are most valuable to the classical student. The campaign is depicted from its very opening. The first view, at the bottom of the column, shows the Roman soldiers shipping their stores; others exhibit the army in the work of building camps; the emperor sacrificing for the favour of Jupiter, and exhorting his cohorts; the Roman soldiers in conflict with the Dacians, with the various means then followed of defence and attack. The thorough manner in which the Romans appear to have built their stone camps, and the care with which they constructed roads to assist their warlike operations, are strikingly shown. The number of human figures, exclusive of other objects, such as horses, arms, chariots, &c., represented on the shaft, is said to be nearly 3,000; the number 2,500 has, at all events, been ascertained by actual enumeration. Each of the figures is on an average two feet high. The pedestal is decorated with crowns of victory, garlands, and other insignia of triumph.

THE LOWER TIERS OF TRAJAN'S PILLAR.

"On this pillar," says Gibbon, "the veteran soldier contemplated the story of his own campaigns, and, by an easy illusion of national vanity, the peaceful citizen associated himself to the honours of the triumph."

The column was made by the Emperor Hadrian a place of sepulture for the ashes of Trajan, which, according to a tradition immortalised by Byron, were supposed to have been contained in the head of a spear, or, according to another version, in a globe which the statue of Trajan, placed on the summit of the column, bore in its hand. The general effect of the column, as it stood originally in the centre of Trajan's Forum, surrounded by colonnades, must have been equally grand and picturesque. It was completed A.D. 114, six years after its commencement. A very good idea of the elaborate ornamentation of this column may be obtained from the cast in the South Kensington Museum of its four lower tiers. It is from this cast that our illustration is taken.

Sagacity of Animals.

INSTINCTIVE COUNTERFEITING OF DEATH BY INSECTS.—This is a common device among spiders, moths, and various species of beetles, and varies in character according to the habits of the species. Many of the moths, when they think themselves in danger, draw their antennæ as well as their wings close to their body, and in this state they may be tossed about without manifesting the smallest sign of life or motion, as many of our readers may have observed on catching them. The common "miller moth," known to most school-boys, is a remarkable adept in this art. The small grey beetle, which makes pin-holes in old furniture (called scientifically *Anobium pertinax*), is another common example of this instinct. This little beetle has received from naturalists the title of *pertinax* from its pertinacity in counterfeiting death. A celebrated Swedish entomologist, De Geer, says that he has found it to equal, if not exceed, the heroic firmness of the American Indians in bearing torture. You may maim them, he asserts, pull them limb from limb, and even roast them over a slow fire, without making them move a joint, or exhibit the slightest symptom of suffering pain. Spiders, also, may be similarly tortured and maimed when they counterfeit the attitude of death. It is very common, also, with the little beetles called *byrrhi* to draw in their feet and antennæ so as to give themselves the appearance of a pill, from which they take their name of pill-beetles. The common wood-louse is also well known to roll itself up in a ball when apprehensive of danger, so that only the plates which form the covering of the back are visible. No doubt these plates, insignificant as they may seem, are an effectual protection to the insect against the attacks of some of its enemies. It is remarked in Kirby and Spence's "Introduction to Entomology" that the common dung-chafer (*Scarabæus stercorarius*)—the black, purplish, shining beetle which is found on almost every road in England—deceives its enemies, the rooks, by setting its legs as stiffly as if they were made of iron wire, and remaining perfectly motionless; and, as the rooks will only eat them when alive, this stratagem is an effectual protection. That this simulation of death is not the consequence of strong convulsion caused by fear, is proved by the fact that the insect makes off with all speed the instant the object of alarm is removed; whereas, if it were a convulsive attitude, it could not resume its movements at pleasure.

THE CUNNING OF A FOX.—The proverbial cunning of a fox is well illustrated in the following anecdote from St. John's "Sutherlandshire:"—"I have been assured by a person not given at all to exaggerate, nor easily deceived, that he once witnessed the following trick. Very early one morning he saw a fox eyeing most wistfully a number of wild ducks feeding in the rushy end of a highland lake. After due consideration, the fox, going to windward of the ducks, put afloat in the loch several bunches of dead rushes or grass, which floated down amongst the ducks without causing the least alarm. After watching the effects of his preliminary fleet for a short time, the fox, taking a good-sized mouthful of grass in his jaws, launched himself into the water as quietly as possible, having nothing but the tips of his ears and nose above water. In this way he drifted down among the ducks, and made booty of a fine mallard. Though this story seems extraordinary, it must be remembered that the fox manages to capture wild ducks, wood-pigeons, hares, and numberless other animals, sufficient to keep himself and family; and it is self-evident that in doing so he must practise many a trick and manœuvre that would seem most improbable if related, and quite beyond the instinct of animals." Another anecdote, quite as striking as an illustration of the fox's wonderful sagacity, appeared, a few years back, in a Preston paper. A farmer of that neighbourhood had discovered that a fox came along a beam in the night to seize his poultry. He accordingly sawed the end of the beam nearly through, and in the night the fox fell into a place whence he could not escape. On going to him in the morning, the farmer found him stiff, and, as he thought, lifeless. Taking him out of the building, he threw him on the dung-hill, but in a short time Reynard opened his eyes, and, seeing that all was safe and clear, galloped away to the mountains, showing more cunning than the man who ensnared him.

A SAGACIOUS NEWFOUNDLAND DOG.—At certain seasons of the year the streams in some parts of North America, not far from the coast, are filled with fish to a surprising extent. A real Newfoundland (which, by-the-bye, is much slighter in make than we in England generally conceive), belonging to a farmer who lived near one of those streams, used to keep the house well supplied with fish. He thus managed it:—He was perfectly black, with the exception of a white fore-foot, and for hours together he would stand almost immovable on a small rock which projected into the stream, keeping his white foot hanging over the ledge as a lure to the fish. He remained so stationary that it acted as a very attractive lure; and whenever curiosity or hunger tempted any unwary fish to approach too close, the dog plunged in, seized his victim, and carried him off to the foot of a neighbouring tree; and on a successful day he would catch a great number.—*Lieut.-Col. Hutchinson's "Dog-breaking."*

DISCOVERY OF IDENTITY FROM THE FLASH OF GUNPOWDER.

AMONG the singular questions which have been started in Medical Jurisprudence—says Dr. Taylor, in his work on that subject—the following is not the least perplexing:—Whether a person who fires a gun or pistol at another, during a dark night, can be identified by means of the light produced in the discharge? This question was first referred to the Class of Physical Sciences in France in 1809, and they answered it in the negative. A case tending to show that their decision was erroneous was subsequently reported. A woman positively swore that she saw the face of a person, who fired at another during the night, surrounded by a kind of glory, and that she was thereby enabled to identify the prisoner. This statement was confirmed by the deposition of the wounded party. Desgranges, of Lyons, performed many experiments on this subject, and he concluded that on a dark night, and away from every source of light, the person who had fired the gun might be identified within a moderate distance. If the flash was very strong, the smoke very dense, and the distance great, the person firing the piece could not be identified.

The question was raised in this country in the case of the "Queen v. White," at the Croydon Autumn Assizes, 1839. A gentleman was shot at while driving home in his gig during a dark night; he was wounded in the elbow. When he observed the flash of the gun he saw that the piece was levelled towards him, and the light of the flash enabled him to recognise at once the features of the accused. In cross-examination he said he was quite sure he could see the prisoner, and that he was not mistaken as to his identity. The accused was skilfully defended, and he was acquitted. Evidence of this kind has, however, been received in an English court of law. A similar case was tried at the Lewes Lent Assizes, 1862, "Reg. v. Stapley." The prisoner shot at the prosecutor, a game-keeper, on a dark evening in December, and the latter swore that he distinctly saw the prisoner by the flash of the gun, and could identify him by the light on his features. This evidence was corroborated by three witnesses who saw him not far from the spot, and by one who saw him in the act of running away, and the prisoner was convicted.

WATER UNDER PRESSURE AS A MOTIVE POWER.

ALL liquids possess the double property of being incompressible and of exerting a pressure in every direction against the sides of a containing vessel. The result of these two properties combined is that if a vessel be entirely filled with water and completely closed, any outside pressure exerted against the vessel sufficient to force *inwards* any portion of its side, *must force outwards* some other portion, the amount of water displaced being exactly equal in both operations. Imagine, now, two tubes (A and A′, Fig. 1), closed at the bottom, one of twelve inches diameter inside, and one of one inch, each having a solid plug or "ram," B and B′, fitting water-tight into them. Let them be connected by a tube, T, and the whole filled with water. If now the ram B′ be pressed down, the water in A′ will be forced through the tube, T, into the larger cylinder, and will push up the ram B. Now as the diameter of B is twelve times greater than that of B′, the area of its base will be 144 times as great as the area of B′, and the consequence is that whatever force is applied to B′ to press it down, that force is multiplied 144 times in its effect upon B. This method of gaining power through the medium of water is called the hydraulic press. There is no simpler method of obtaining an equal force, and it

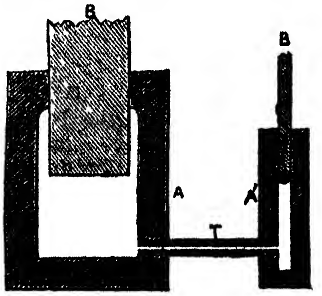


Fig. 1.

is easy to understand that scarcely any limit exists to the power obtainable by this means.

By means of this press, cotton is compressed so tightly that bands of iron are necessary to bind it up to prevent it expanding afterwards; and thus very much more cotton can be packed in a ship's hold than could otherwise be done. By this press the largest ships are not only (as was the case with the *Great Eastern*) pushed from the cradles upon which they were built into the water, but actually lifted bodily out of the water, with their masts and stores on board, to have their bottoms examined and repaired.

But the most beautiful application of hydraulic pressure, not only in the work done by it, but in the method of obtaining and utilising the pressure, is that invented by Sir W. Armstrong.

In nearly all the large docks in the kingdom, and in many large warehouses, are to be seen cranes worked entirely by water pressure. The whole mechanism of them is remarkably ingenious.

We will first explain the method of obtaining and keeping up the required pressure. In a separate building is a double-cylinder steam-engine, which is wholly employed in pumping water. Upon its shaft is a large fly-wheel, intended to impart steadiness of motion to the whole; but notwith-

standing this, the speed is observed to be constantly varying, and frequently the engine stops altogether for a short period. The cause of this unevenness of motion we shall presently see. In a tall, tower-shaped building adjoining the engine-house is an exceedingly strong, upright iron cylinder, about sixteen feet high and five feet in diameter, into which the water pumped by the engine is forced. In this great cylinder is fitted, water-tight, a great plunger or ram, and across the top of it is fixed a strong piece of iron like the top of the letter T, the ends of which enter grooves or guides of iron fixed to upright timber supports, and upon this cross-piece of iron rests an immense weight of many tons. When the water is forced into the great cylinder it pushes up the ram with the weight upon its top. As soon as the ram has been pushed up nearly to the top of the guides, a simple, self-acting arrangement begins to shut off the steam from the boiler, thus reducing the speed of the engine, and when the ram has risen up to its full height the same arrangement quite shuts off the steam and stops the engine. Directly any water is allowed to escape from the cylinder, the descent of the ram re-admits the steam, and the engine again begins pumping. Hence the reason of the constant variation in the speed of the engine.

The great cylinder and its appurtenances is called an "accumulator," because within it is stored up or *accumulated* the compressed water, by the agency of which the cranes are worked, the pressure being the result of the weight resting upon it. From this accumulator is led a pipe or series of pipes placed underground, which conveys the compressed water to the cranes, whither we will follow it, and observe the machinery upon which it acts.

Each crane requires an independent but similar machine which is placed underground, and it is so much like a double pulley in principle, only applied in reversed order, that it will be necessary to explain the one in order to comprehend the other.

A double pulley consists of two single pulleys acting together as in Fig. 2. A rope or chain is passed backwards and forwards over the several wheels, one end being fastened to one of the blocks, and the other available for being pulled.

If the end which is held in the hand be drawn, the two pulleys will be brought together with great force, although the *speed* with which they approach will be small in comparison with that with which the rope is drawn.

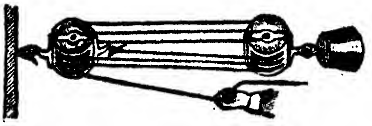


Fig. 2.

Now, suppose that instead of pulling the rope, we push asunder the pulleys, it is evident that although we should lose power, we should *gain speed* in the rope—that is, the rope will be drawn back much faster than the pulleys move. This, then, is the action of the hydraulic crane. Between the two pulleys is placed an hydraulic ram, to the bottom end of the cylinder of which is fixed the frame of one pulley, and to the end of the ram the frame of the other pulley. Fig. 3 shows the arrangement. A is the cylinder laid horizontally underground, and B the ram. To the two cross-heads, E and E′, are fixed the pulley-frames; the ropes or chains, after passing backwards and forwards over the wheels, being led up through the ground and united into one, in which state they pass over the crane. A branch pipe, P, connected with that communicating with the accumulator, is fixed into the cylinder, and a valve in this branch pipe, worked by a lever brought above ground, admits or shuts off the compressed water at pleasure; whilst another lever opens or closes a cock attached to the cylinder, to allow the enclosed water to escape, when the ram has to be pushed back.

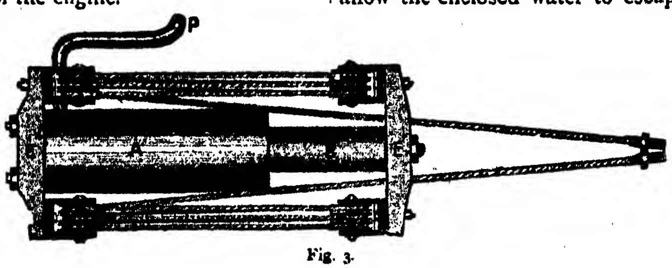


Fig. 3.

Here, then, is the whole secret of the hydraulic crane. When water is admitted to the cylinder, the ram is forced out, thus separating the blocks, and drawing back the chain, raising the weight attached to its extremity. When the compressed water is shut off, the chain remains stationary, to allow the crane to be swung round; and when the water inside the cylinder is allowed to escape, the weight at the end of the chain draws the two pulleys together, and pushes back the ram. A heavy ball of iron is permanently attached to near the end of the chain, to perform this latter office, when no other weight depends from it.

The same principle which we have described as applied to the cranes, is applied also to opening and closing the dock gates. In this case the chain is led away to the gate to which it is fastened, which, being forcibly pulled by the pushing out of the ram, draws the gate open. Another chain upon the other side of the gate, by a similar arrangement, closes it when required.

THE AURORA BOREALIS.

known. There can, however, be no doubt that if it be not due to electricity itself, it is closely allied to it. When the Aurora is being displayed, the magnetic needles are agitated, and currents of electricity stream along the telegraph lines, causing the needles to deflect; the most remarkable fact being that the influence which the Aurora has on telegraph lines is totally different to that exercised by a thunder-cloud. In 1859, at the end of August, the Aurora monopolised for hours and worked on its own account several of the lines in the United States, chiefly those which had a direction from north to south. The European telegraphs were similarly affected by the same Aurora.

Every philosopher knows that electricity plays a very prominent part in the affairs of our earth; but as yet we are all but ignorant of its exact effects. Yet it would seem that the Aurora indicates the path of vast currents of electric fluid which circulate through and about our world. The streams always appear to leave one pole for the other. The phenomenon at the southern pole is termed the *Aurora Australis*.

DIAMOND-WASHING IN BRAZIL.

Captain Burton, in his recently published work on "The Islands of the Brazil," gives the following account of the diamond-washing in the mines of that country:—"As the Brazil borrowed her gold mining through Portugal from the Romans, so she has taken her system of diamond-washing from Hindostan. The washing here begins with the rains about November. The upper parts of the troughs are charged with cascalbs (diamond earth), and a man, standing before the open end or at the side, dashes water upon the contents; he then stirs with the fingers the mass, to relieve it of the worthless earth, dust, and clay, till the water runs clear, and this washing may be repeated. Thus a pocket of diamonds is sometimes, but very rarely, hit upon. The fortunate slave no longer claps his hands in the old style of signal. He may receive his freedom after finding a stone weighing more than an oitava and a half; not by law, however, but in order to encourage the other labourers. The gravel may be treated a dozen times or more, and precious stones, of course very diminutive, will still be found in it. A good washer takes from half to three quarters of an hour in order to exhaust a single pan-full.

"Magnifying-glasses are not yet in use, yet they would save much trouble and prevent loss. The present rude system is very severe upon the sight, which soon fails. Past twenty-five few eyes can be trusted, and children are always the best washers. It is during this treatment that robberies are mostly effected. Few swallow the diamond, not because it is considered poisonous, as by the Hindoo, but on account of the difficulty of doing so unobserved. In India the miner jerked the stone into his mouth, or stuck it in the corner of his eye; twelve to fifteen overseers were required per gang of fifty light-fingered men. The civilised thief pretends to be short-sighted, and picks up the plunder with his tongue-tip. A favourite way is to start as if frightened by a snake, and thus to distract the attention of the superintendent, who, if clever, is wide awake to the trick. Most of the stones disappear by being tilted or thrown over the lip of the pan during the washing, and are picked up at leisure."

WONDERFUL SPIDER'S WEB.

Across the "sunny paths" of Ceylon, where the forest meets the open country, and which constitute the bridle-roads of the island, an enormous spider stretches its web at the height of from four to eight feet from the ground. The cordage of these webs is fastened on either side to projecting shoots of trees or shrubs, and is so strong as to hurt the traveller's face, and even lift off his hat, if he is so unlucky as not to see the line. The nest in the centre is sometimes as large as a man's head, and is continually growing larger, as it is formed of successive layers of the old webs rolled over each other, sheet after sheet, into a ball. These successive envelopes contain the limbs and wings of insects of all descriptions, which have been the prey of the spider and his family, who occupy the den formed in their midst. There seems to be no doubt that the spider casts the web loose and rolls it round the nucleus in the centre when it becomes overcharged with carcases, and then proceeds to construct a fresh one, which in its turn is destined to be folded up with the rest.

NAPOLEON AT MOSCOW.

Five hundred thousand men, drilled and disciplined into as fine an army as ever were under the command of general—veterans who had proved their prowess on many a hard-fought field, and followed Napoleon's eagles to victory. A gallant army, rich in all the pomp of war—cavalry, infantry, and artillery, with a mighty baggage train; for the Russ was now to be humbled, his capital seized, a new treaty entered into, and Poland the oppressed to be torn off once more and elevated into a kingdom.

The French crossed the Niemen on the 24th of June, 1812, when Wilna and Witepsk soon fell; and then, as army after army tried to oppose his way, Napoleon routed the Russ till the enemy melted away before him, and the conqueror made a grand entry into Moscow, where, under the impression that the Emperor Alexander would

send an embassy soliciting peace, the victor stayed impatiently for six weeks. But not in ease and comfort, for the French had hardly occupied the city before there was an alarm of fire; and again, in different parts of the city, the fires took the form of a fearful conflagration; for, lest the French should make Moscow their winter quarters, the Russians had fired their city. The Russian policy was now evident: to call in the aid of famine and their inclement winter to fight against the foe. And then, finding at last that, so far from his victorious march achieving any definite object, there was nothing left for him but to retreat, Napoleon gave the word, and his vast army was once more in motion.

The return was commenced towards the end of October, and almost as soon as the army was well in motion down came the snow. Napoleon's soldiers, indomitable before men, seemed to wither and fade before the keen blast of the early winter that had now set in. There was no taking advantage of this town or that village for shelter, for everywhere the Russians prepared fire and ruin for the retreating troops; and while men, numbed with cold, were falling out from their ranks in the French army, the well-clad, fur-caped warriors of Kutusoff could harass the rear, and cut up the stragglers with impunity.

But there was discipline ever, and the French showed a bold front, for their great idol was with them, and Murat, Ney, and Davoust were in command of divisions. Onward ever, but through weather hourly growing more fearful. The roads trampled by the feet of marching thousands soon became ploughed by the wheels of gun and tumbril, and horses would toil on till they fell and lay struggling, adding to the confusion by striking their fellows from their feet, till they lay in a tangle of muddy and snowy harness, which the numbed fingers of the soldiery could not disentangle.

Soon the snow deepened, and the frost came, turning it into a fine dust that, sweeping before the fierce gale, seemed to pierce them to the bone. Then a few intervals of thawing, when the trampled route would soon grow into a miry slough. From all being regularity and discipline, the rear of the grand army now began to grow into a wild crowd of tired and struggling men, using their last efforts to keep up with the forced march, and only saved from being cut to pieces by the efforts of the rear guard. And at night men huddled together gazing blankly at each other, and not daring to tell of the despair in their hearts.

Harassing attacks, and men cut off from the main bodies. Pursuit was never dreamed of, the sole object of the French generals being to make good their retreat. Men struggling through the snow, collecting it at times to try and quench the famine thirst, but only to make it more keen. Food frightfully scarce — foraging vain — and a terrible selfishness now animating men's hearts; but forward still, to the same weary death march of their own tramp—a dread funeral march; for the army was melting away with a rapidity inconceivable, and men began to look with longing eyes now at the soft white inviting couch on either side. They were wearied and despairing, and must rest. To the last the commands of their officers were obeyed; but there was a point when, with freezing feet, they could do no more; it was either to fall in the ranks and be trampled by the coming thousands behind, or to drop out to accept the sleep that nature offered.

Night again: the troops, still in a state of discipline, halting and going through their few poor arrangements in a strange mechanical manner, while the ever-increasing mob of the disorganised in the rear huddled together wherever a fire could be made.

Smolensk was reached at last, and here supplies were expected; but no—from mismanagement there was nothing for the wretched army but despair, and to press on again in the disastrous retreat. Their numbed and frozen hands could retain their weapons no longer, as, with ice clinging to their beards, they still struggled on, band after band of coming fugitives, the crowd of a disorganised army, and then the rear guard ever battling in their defence. The road strewn with accoutrements, bodies of men, bodies of horses, guns, wagons, tumbrils, the *disjecta membra* of the great army; then the falling snow, and a few hours after the winding-sheet of nature covering all.

Frozen marshes, vast pine-forests, howling winds, endless plains, a journey apparently without a termination. The regiments that had kept orderly now growing confused; commissariat arrangements, in spite of the efforts of the officers, at an end; and to the most hopeful it became evident that *sauve qui peut* must soon be the order of the day.

And now came the crowning horror; for the River Berezina was reached, and with the river in their front, the Russian army in their rear, the French came to a halt—the mighty army of half a million men reduced to fourteen thousand still in a state of discipline, and a vast, uncounted, disorganised crowd of followers. Two frail bridges were constructed, and the wreck of the army pressed on to cross; their foe, at the same time, vigorously attacking the rear guard.

The bridges sway and creak, but men press on, for there is the sharp fusillade of musketry behind, and an occasional Russian round shot ploughs its way through the crowd. All these thousands to cross, when there comes a sickening crash: one bridge had given way, and a vast crowd of human beings was struggling in the ice-laden waters. And all this with a dreadful slaughter in progress, the Russians charging on, driving the fugitives before them, playing upon them from their guns, and

ending the order that had so far existed, by turning the retreat into one vast rout.

History is silent as to the numbers slain, drowned, trampled to death in the passage of the Berezina; but she makes humanity shudder with the account of the bodies in the river frozen into one dense mass. And all these horrors succeeded by the stern silence of winter—the falling snow hurriedly hiding all, covering the heaps of slain, giving to the wounded struggling in agony a calm lulling sleep, against which struggling was vain; for in the midst of a frost-locked and devastated country help was not.

The stern winter hid for months the horrors, but as spring once more visited the earth, and its snowy garment slowly dissolved away in the swollen rivers, the sun began to shine upon the relics of the war. Arms, accoutrements, the tawdry trappings of the privates and the rich uniforms of the officers, all were there; but, in all the fearful stiffness of death, to a man almost either young or in the prime of life, there were 300,000 corpses of their enemies for the Russians to bury; and in vast funeral pyres, as of sacrifices to the blood-stained god of French glory, 160,000 dead horses to burn.

LUMINOUS PLANTS.

In a contribution to the "Journal of the Agricultural and Horticultural Society of India," Major Madden gives an account of some luminous plants of that country, which in the dark emit a phosphorescent light, while even portions of the root possess the same property. He states that one of these was discovered by a native, who was compelled by rain to take shelter at night under a mass of rock, where he was astonished to see a blaze of phosphoric light over all the grass in the vicinity. Plants of this kind had long been known to the Brahmins under the name of Jyotismati. On inquiry at Almorah the major found that there was a luminous plant well known there by that name, and another implying the possession of light or fire. It turned out to be *Anthistiria anathera*, of which perhaps one root in a hundred is luminous by night during the rainy season. Other grasses are reported to possess the same property, and in 1845 the people of Simlah were open-mouthed with a rumour that the mountains near Syree were nightly illuminated in this manner. A plant known in Europe as *Dictamnus fraxitella* has the same quality, and as this abounds in some parts of the Himalayas, the fame, says the major, of a bush burning but not consumed, would be spread afar by the pilgrims, among a people ever ready to deify any peculiar manifestation of fire.

Professor Henslow explains the inflammable atmosphere generated on a calm, still evening about by the evaporation of a volatile oil, and states that "if a candle be brought near it, this plant is enveloped by a transient flame without sustaining any injury from the experiment." Baron Hugel was told that the Auk river, in Cashmere, when swollen with rain, brings down from Thibet pieces of timber which shine in the dark as long as they continue moist. The rootstock of a plant from the Ooraghum jungles, supposed to be an Orchid or Marica, was exhibited at a meeting of the Royal Agricultural Society, and "possessed the peculiar property of regaining its phosphorescent appearance when a dried fragment was subjected to moisture, gleaming in the dark with all the vividness of the glow-worm, after having been moistened with a wet cloth applied to its surface for an hour or two. It does not seem to lose the property by use, becoming lustreless when dry, and lighting up again whenever moistened." Dr. Lindley states that "a small slice of the dried root being wrapped in a wet cloth, and allowed to remain about an hour, shines in the dark like a piece of phosphorus, or perhaps somewhat paler, more like dead fish or rotten wood."

WONDERFUL VOLCANIC ERUPTIONS.

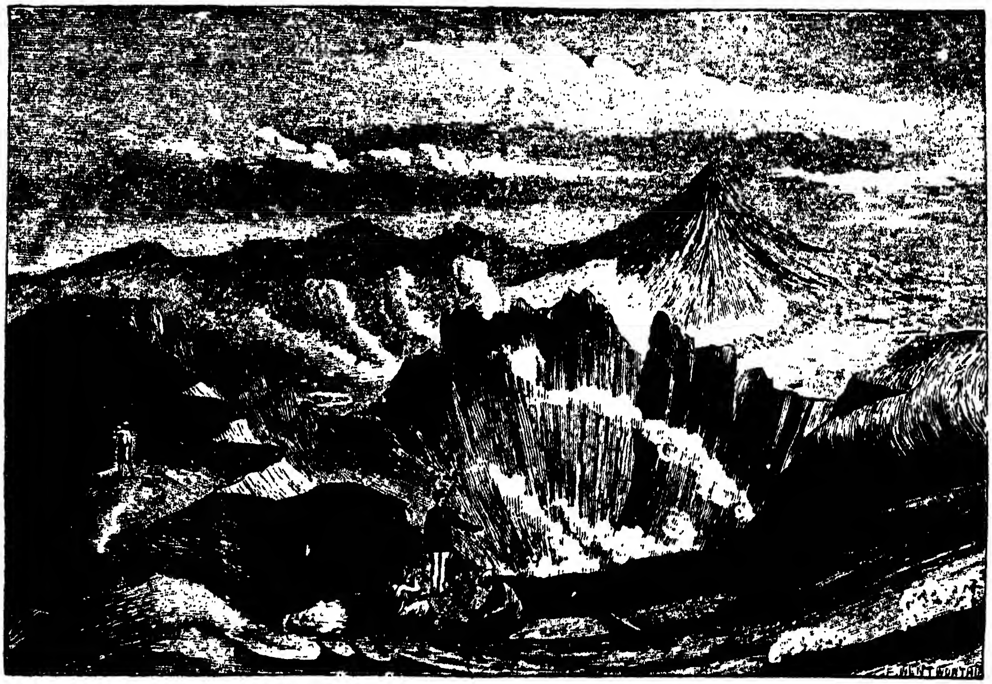
No one who has ever seen a volcano or burning mountain casting forth steam, huge red-hot stones, smoke, cinders, and lava, can possibly forget the grandeur of the spectacle. At night it is doubly terrible, when the darkness shows the red-hot lava rolling down the hill-side. Sometimes the mountain is quiet, and only a little smoke curls from its top, and even this may cease, and the once burning summit may be covered over with trees and grass, like any other hill. But deep down in the earth the gases and pent-up steam are ever preparing to rush up through the mountain, and to carry with them dissolved rocks, slag, and the stones which block up their passage. Sometimes, whilst all is calm and beautiful on the mountains, suddenly deep-sounding noises are heard, the ground shakes, and a vast torrent tears its way through the bowels of the volcano, and is flung hundreds of feet high in the air, and falling again to the earth, destroys every living thing for miles around. Such a scene occurred forty-seven years ago in the Island of Java.

Java is a mountainous island—one of the East Indies. It has a splendid climate, and its fertility is very great. A large native population and many European settlers are employed in cultivating spices, coffee, and woods. The island is rather more than 600 miles long, and it is not 150 miles broad in any part; and this narrow shape is produced by a chain of volcanoes which runs along it. Some of the volcanoes are constantly in eruption, whilst others are inactive. One of their number, Galung Gung, forty-seven years ago, was covered from top to bottom with a dense forest

around it were populous villages. The mountain was high; there was a slight hollow on its top—a basin-like valley, carpeted with the softest sward; brooks rippled down the hill-side through the forests, and, joining their silvery streams, flowed on through beautiful valleys into the distant sea. In the month of July, 1822, there were signs of an approaching disturbance; this tranquil peacefulness was at an end; one of these rivers became muddy, and its waters heated. In October, without any warning, a most terrific eruption occurred. Suddenly a loud explosion was heard; the earth shook, and immense columns of hot water, boiling mud mixed with burning brimstone, ashes, and stones, were hurled upwards from the mountain top like a water-spout, and with such wonderful force that large quantities fell at a distance of forty miles. Every valley near the mountain became filled with burning torrents, and the rivers, swollen with hot water and mud, overflowed their banks, and swept away the escaping villagers; and the bodies of cattle, wild beasts, and birds were carried down the flooded streams.

A space of twenty-four miles between the mountain and a river forty miles distant was covered to such a depth with blue mud, that people were buried in their houses, and not a trace of the numerous villages and plantations was visible. The boiling mud and cinders were cast forth with such violence from the crater, that while many distant villages were utterly destroyed and buried, others much nearer the volcano were scarcely injured; and all this was done in five short hours!

Four days afterwards a second eruption occurred more violent than the first, and hot water and mud were cast forth with masses of slag like the rock called basalt, some of which fell seven miles off. A violent earthquake shook the whole district, and the top of the mountain fell in, and so did one of its sides, leaving a gaping chasm. Hills appeared where there had been level land before, and the rivers changed their courses, drowning in one night 2,000 people. At some distance from the mountain a river runs through a large town, and the first intimation the inhabitants had of all this horrible destruction was the news that the bodies of men and the carcases of stags, rhinoceroses, tigers, and other animals, were rushing along to the sea. No less than 114 villages were destroyed, and above 4,000 persons were killed by this terrible catastrophe.



VOLCANO IN JAVA.

Many years before this eruption, one of the highest burning mountains of Java was constantly throwing out steam and smoke, but as no harm was done, the natives continued to live on its sides amongst the dense forests. Suddenly this enormous mountain fell in, and left a gap fifteen miles long and six broad. Forty villages were destroyed, some being

carried down and others overwhelmed by mud and burning lava. No less than 2,957 people perished, with vast numbers of cattle; moreover, most of the coffee plantations in the neighbouring districts were destroyed.

Even more terrible was the eruption of Mount Salek, another of the volcanoes of Java. The burning of the mountain was seen 100 miles away, while the thunders of its convulsions and the tremblings of the earth reached the same distance. Seven hills, at whose base ran a river—crowded with dead buffaloes, deer, apes, tigers, and crocodiles—slipped down and became a level plain. River-courses were changed, forests burnt up, and the whole face of the country completely altered.

INFLUENCE OF THE CLIMATE ON COLOURS.

THERE is a remarkable correspondence between the geographical position of a region, and the colours of its plants and animals. Within the tropics, where "the sun shines for ever unchangeably bright," the darkest green prevails over the leaves of plants, the flowers and fruits are tinctured with colours of the deepest dye, whilst the plumage of the birds is of the most variegated description and of the richest hues. In the people also of these climes there is manifested a desire for the most striking colours, and their dresses have all a distinguishing character, not of shape merely, but of chromatic arrangement. In the temperate climates everything is of more subdued variety; the flowers are less bright of hue; the prevailing tint of the winged tribes is a russet-brown; and the dresses of the inhabitants of these regions are of a sombre character. In the colder portions of the earth there is but little colour; the flowers are generally white or yellow, and the animals exhibit no other contrast than that which white and black afford. A scale of colour might be formed, its maximum point being at the equator and its minimum at the poles. The influence of light on the colours of organised creation is well shown in the sea. Near the shores we find seaweeds of the most beautiful tinctures, particularly on the rocks which are left dry by the tides; and the rich hues of the actiniæ, which inhabit shallow water, must have been often observed. The fishes which swim near the surface are also distinguished by the variety of their colours, whereas those which live at greater depths are grey, brown, or black. It has been found that after a certain depth, where the quantity of light is so reduced that a mere twilight prevails, the inhabitants of the ocean become nearly colourless. That the sun's rays alone give to plants the property of reflecting colour, is proved by the process of blanching, or the state produced by artificially excluding them from light.—*Hunt's "Poetry of Science."*

CURIOSITIES OF GLASS-MAKING.

OF the manufacture of glass it has been said that, "although perfectly transparent itself, not one of the materials of which it is made partakes of that quality." Its origin is uncertain. Josephus claims the discovery for the Israelites; Pliny assigns it to the Phœnicians, and states that the first glass-houses were erected in Tyre, where the only staple of the manufacture existed for many ages. Herodotus and Theophrastus likewise confirm the fact of the use of glass having been known in the earliest periods of civilisation, and of the establishment of glass-works in Egypt and Phœnicia, and even in India, where rock crystal was employed in its composition.

The art of making glass is reputed to have been discovered by accident. Pliny states, some Phœnician mariners who had a cargo of *nitrum* (salt, or, as some have supposed, soda) on board, having landed on the banks of the Belus, in Palestine, and finding no stones to rest their pots on, placed under them some masses of *nitrum*, which, being fused by the heat with the sand of the shore, produced a liquid and transparent stream. Now the sand which lay about half a mile round the river was peculiarly well adapted for the making of glass. The Sidonians, in whose country the discovery was made, took it up, and in process of time carried the art to such perfection that they are even said to have invented glass mirrors. Yet the manufacture of glass was, a few years since, unknown at Sidon, where it is reputed to have been first invented. The above account by Pliny is, in substance, corroborated by Strabo and by Josephus; yet it was long asserted that the ancients were unacquainted with glass, properly so called. Nor did the denial entirely disappear even when Pompeii presented evidence of the skill of the ancients in glass-making.

The process of manufacture detailed by Pliny appears to have been very much the same as that practised at the present time. And Sir Gardner Wilkinson gives the representation of two glass-blowers inflating a piece of molten metal, by means of hollow tubes, taken from a painting of Beni Hassan, executed during the reign of that monarch, who lived about 3,500 years ago; and adds that glass vases, if we may trust to the Theban paintings, are frequently shown to be used for holding wine as early as the Exodus, about 1400 years before the Christian era. Such was the skill of the Egyptians in glass-making, that they successfully counterfeited the amethyst and other precious stones worn as ornaments for the person. Winckelmann, a high authority, is of opinion that glass was employed more frequently in ancient than in modern times; it was used by the Egyptians not only for drinking vessels, but for mosaic work,

the figures of deities and sacred emblems, in which they attained excellent workmanship and surprising brilliancy of colour. The remains of Alexander the Great are said by Suetonius and Strabo to have been delivered to Augustus, when he was in Egypt, in a glass-case in which Seleucus had deposited them after removing them from a golden urn. Glass was used by the Egyptians for coffins, and in 1847 a process was patented in England for making coffins of glass. It would be reasonable to suppose that the Hebrews brought glass, and a knowledge of its manufacture, out of Egypt, were not the evidence of history so explicit that it was actually discovered and wrought at their own doors.

Archimedes is stated to have constructed an orb of glass for scientific purposes; and optical glass has been found at Nineveh, in a microscope glass. There is also, in the British Museum, a perfect and beautiful goblet, excavated by Layard from among the ruins of Nineveh. It has a name—probably that of the contemporary sovereign, or of the maker—engraved upon it; and from the characters employed, and the locality in which it was found, it is believed to be of date seven centuries before the Christian era, and *probably the most ancient piece of manufactured glass in existence.*

In the reign of Tiberius, glass-works were first established near Rome, and various sums were paid for vases or goblets. Glass was not only an article of luxury or ornament in the palaces, but employed to decorate altars and the tombs of the dead. Many fragments have been found in the catacombs, showing it to have been used likewise by the early Christians in their places of worship. In the above reign a Roman artist had, according to Pliny, his house demolished (according to others, he was beheaded) for making glass malleable. The Pompeian and Roman architects are known to have used glass in their mosaic decorations; of these, remains have been found among the ruins of the villa of the Emperor Tiberius, in the island of Capri. Several specimens are also yet to be seen in Westminster Abbey, cemented into the sides of the tomb of Edward the Confessor in flat pieces, the under layer reddish and opaque, and the upper white and transparent, gold leaf between, and the whole fixed into one substance.

The clear glass resembling crystal was so costly, that Nero gave for two cups of no extraordinary size, with two handles, 6,000 sestertia, or nearly £50,000. Glass vessels are made to imitate precious stones, cut by the lathe in the style of cameos in relief, by Roman artists. In the British Museum are preserved many fragments of vases of white opaque enamel glass upon blue and amethyst grounds. White crystal glass without lead, cut to imitate rock crystal, was then known; and a few pieces of this cut glass, considered Roman, have been found in the City of London.

THE BEGGARS' SQUARE AT CANTON.

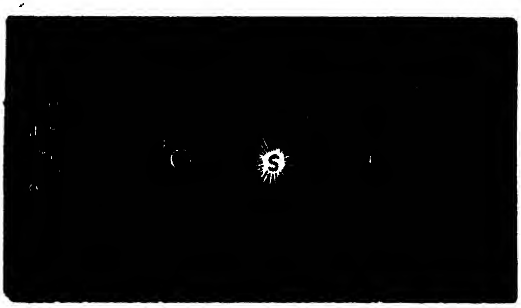
THE cruelty of the Chinese to the sick and infirm is strikingly illustrated in the following extract from Smith's "Cities of China:"—"I walked with two friends about a mile and a half in a north-easterly direction from the factories into a part of the suburbs called the Beggars' Square. It consists of an open space of about a hundred yards on each side, and has a continued range of temples on one side extending into the adjacent streets. We proceeded into the centre of the square, where numbers of idle vagabonds were pursuing their various methods of amusement or of vice. A number of emaciated pale forms were also to be seen, partly covered with mats. Some were gasping for breath and were scarcely able to move, others were motionless and seemed destitute of life. Numbers of poor mendicants, on the approach of sickness, are brought hither by their relatives and left to perish, in neglected and unpitied destitution. One poor youth, with a look that pierced my inmost soul, had just sufficient strength to stretch his hand for temporary relief, which was, alas! now unavailing. I counted four or five close by to all appearance dead. Desirous of assuring myself of the fact, I stooped, and, removing the scanty matting which partly obscured their pallid features, gazed on the ghastly spectacle of death. Within three or four yards of the corpses a company of noisy gamblers were boisterously pursuing their nefarious vocations."

THE WONDERS OF LIGHT.

BEAMS of light shoot through the fields of space with the prodigious velocity of 196,000 miles a second; so that a wave of light issuing from the fires of the sun speeds on its journey for eight minutes before it reaches our world. If in the days of great Queen Bess that same engineering enterprise which floated the Spanish Armada had been able to span the 93,000,000 of miles which separate us from the regal centre of our system with a railway viaduct; if a trip to the sun had been advertised by the "runners" of the day, and a train equipped for the journey—supposing it never stopped at any of the planetary stations, but rushed on forty miles every hour—it would just now be entering the terminus of the Sun; and yet this space, which one of our express trains could only travel in 270 years, is passed through by a beam of light in eight minutes! How can such rapid motion be measured? The finding of the velocity of light is no less wonderful than the velocity itself.

In the year 1676 the Danish astronomer, Olaus Roemer, observed certain eclipses of the moons of

Jupiter. Now we know all about the four moons which circle round the bright and lovely planet which so often is a conspicuous object in our heavens, and therefore we know when they pass behind the planet and so become eclipsed. The exact time of these eclipses is calculated, and is one means by which sailors can find out where they are on the ocean—that is, how far east or west they are from Greenwich. It is necessary to do this that they should have "Greenwich time," but the very best chronometers vary, and therefore tables are published, in which the times of the eclipses of the moons of Jupiter are given. Suppose that to-night one of the moons passes behind the planet at ten o'clock precisely, the captain of a vessel is not sure that his chronometer is right, so to him Jupiter and his moons become a watch; he turns his telescope upwards, observes the instant the little bright spot is lost behind the disc of the planet, and then he knows it is just ten o'clock by Greenwich time. This was the very thing Olaus Roemer was about, but he could not understand how it was that when he made his observations when Jupiter was nearest the earth the eclipse always happened too soon, and if the planet happened to be on the other side of the sun—the furthest possible distance from the earth—it took place nearly sixteen minutes too late. The explanation of the astronomer's difficulty will be readily comprehended from the diagram.



When the observation was made when the earth was at E, Roemer found the eclipse took place sixteen minutes sooner than it would have appeared to do had the earth been at F, the opposite side of her orbit.

There was only one way of accounting for this—namely, that the light took sixteen minutes in travelling from E to F, a distance of 186,000,000 miles, to accomplish which its velocity must be 192,500 miles a second. But still more wonderful is it that this prodigious swiftness can be measured with the greatest accuracy by actual experiment; the ingenuity of Fizeau invented the plan by which it can be done. He arranged two telescopes at a distance of 9,440 yards, looking at each other. In the further end of the distant telescope was a looking-glass, and a cog-wheel was so arranged before the near telescope, that if you looked through it you saw the further telescope through the space between two of the teeth of the wheel. If the wheel was moved round a very little, one of the teeth would come before the end of the telescope and shut out the view of the distant object.

When all this was thus adjusted a lamp was placed on the same side of the toothed wheel as the telescope, and a ray of light caused to pass through one of the spaces; of course this light shot away to the other telescope, and was reflected back from the looking-glass in it to the first telescope, passing through the space between the teeth, and so through the instrument to the eye. But suppose that, while the light from the lamp was on its way, before it could touch the reflector more than five miles off, and come back again to the place whence it started, and enter the telescope, as we have said, the wheel had moved, and, when the beam returned to the end of the telescope, instead of finding an opening, it was obstructed by a tooth, and prevented from entering, so that the person looking through the telescope would not see the light. Then to measure the velocity all that is necessary is to look at the reflection of the light in the distant mirror, then set the wheel in motion, being careful to know how many turns it makes in a second, and increase the motion until the light can be no longer seen. Fizeau found that when his wheel, which had 720 teeth, revolved at the rate of a little more than twelve revolutions in a second, the light was eclipsed; from this it was very easy to calculate what time the light spent in passing through nearly eleven miles—to the further telescope and back—and so we learn the fact that light travels at the rate of 196,000 miles a second; and yet some of those stars which glimmer in the firmament above us are so far away that hundreds of years ago they may have been blown into a thousand fragments, and the light of the explosion has not reached us yet, to tell of the star's destruction.

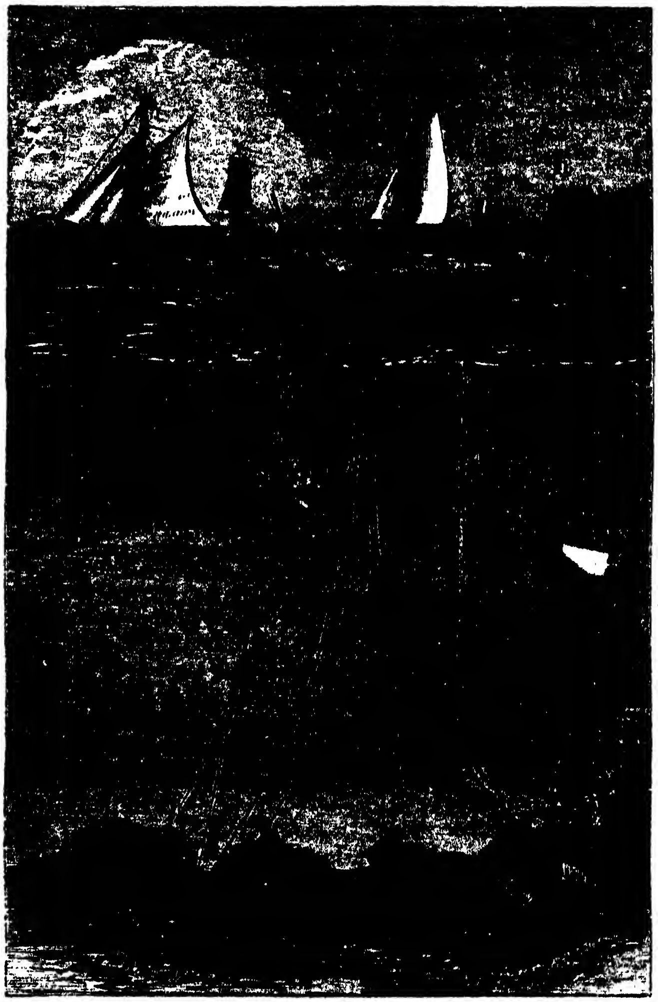
Sound travels much slower than light. It passes through the air at the rate of 1,130 feet a second. This is the reason why we always see the flash of a gun before we hear the report, and in a thunderstorm, if we count the seconds which elapse between the glare of the lightning and the first roll of the thunder, we know that for every five seconds we count the scene of the electric discharge is a mile distant. The waves of sound do not maintain the same velocity in all media; in water they travel at the rate of 4,900 feet a second. This fact was proved at the lake of Geneva, by striking a bell under water at a given signal, and a distant listener, by means of an ear-trumpet, whose mouth was beneath the surface of the water, registered the moment the sound reached him. In some media the velocity is much greater.

PEARL FISHERIES.

THE value of pearls has been in all ages of the world commensurate with their beauty. In the East especially they have been greatly admired, and enormous sums of money have been paid for them. It is said that Julius Cæsar gave a pearl to the mother of Marcus Brutus that was valued at £48,417 10s. of our present money; and Philip the Second of Spain had a pearl from the West

to be worth £30,000. From immemorial there have been fisheries of pearl in the Persian Gulf and Red Sea, and in the bays of Ceylon; and when Columbus arrived in the Gulf of Paria, on his first voyage to America, he

adorned with splendid pearls, as well round their necks as round their arms; yet they were not prized by their possessors, who regarded them only as slight feminine ornaments, so that merely for an earthenware plate—a broken one—that a sailor gave to an Indian woman, she gave him four rows of her pearls." The Spanish king forbade any one to go within fifty leagues of the place where such riches were found without the royal permission, and took possession of the fisheries for himself; but so cruelly did the Spaniards behave to the natives, making them perforce dive for them, and brutally ill-treating them when they were unsuccessful in pearl finding, that, "one morning at dawn the Indians assailed the Spaniards, made a sanguinary slaughter of them, and with dancing and leaping ate them, both monks and laymen." The islands of Cubagua and Margarita were the principal seats of the pearl fishery, which was also carried on in the Gulf of Paria itself, on the coast of Cumanà.



DIVING FOR PEARLS.

The pearl is nothing more than a pellet, varying in size, composed of the same shining, hard, calcareous matter, called nacre

lines the shells

oyster and mussel tribes. They [illegible] re found stick- [illegible] to the [illegible] ng whence they spring, or distinct in the bodies of the animals which produce them, lying loose in the substance

tion of the pearl is in either case some irritating influence acting upon the oyster itself. A grain of sand has insinuated itself between the soft mantle of the oyster and the shell, and to get rid of the annoyance the animal throws over it some of the calcareous secretion which it has power to exude, adding thereto in proportion to the amount of inconvenience it continues to feel. The pearls found in the body of the oyster or mussel are supposed to be abortive eggs which the creature has tried to throw out, but which, remaining, have been coated with

additional nacre in order to render them less uncomfortable. The Chinese have several ingenious methods for making the pearl yielders produce artificial pearls. They introduce into the shell of the creature small irritating objects—beads, nuclei of mother-of-pearl, metal knobs, any small thing, indeed, which the oyster cannot by any means get rid of, but finding it there proceeds to coat over with pearl. In the course of a year the secretion has been so considerable as to sufficiently remunerate those whose labour has been expended upon it.

There are many kinds of shells, not only bivalves, but spiral shells also, in which pearls occur; indeed, it would seem that all polished nacreous shells are capable of producing them, though the oyster family excels in the art. The size of the pearl varies according to the time it has been in process of manufacture, and according to the extent of its irritating cause. Climate, also, has no doubt something to do with it, as the largest and finest pearls are from warm water districts, while the mussels and oysters of colder waters, like those of Great Britain, do not seem to be capable of yielding very large, though they afford many small pearls. The pearl fishery of Scotland, where the people seek the pearl animals in the slime of rivers at low water, affords employment to many hundreds of persons, and yields a profit of several thousands a year.

The deep water fishery—that is to say, the fishery in about twelve fathoms—is conducted now pretty much as it was conducted in Columbus' time. Men accustomed from their infancy to an amphibious sort of life, and trained to be expert divers, are engaged at the work, and go down naked into the sea in order to pick up the marvellous pearl-breeders which lie at the bottom. They may bring up a prize or a blank, but down they go time after time, spending their lives in the occupation, and finding a reward either in wages or in a co-partnership in the lottery upon which they are engaged. In Ceylon, the pearl fishers go out in company in their boats. Each boat carries twenty men, of whom ten are rowers and ten divers. The divers take turn and turn about at plunging, and remain under water for a minute and a half to two minutes. Some of them are said to be able to stay down as long as five minutes, but this power is exceptional, and only to be acquired by long practice. Trained to the work from childhood, the divers go down, with the greatest intrepidity, to a depth of from four to ten fathoms. To assist them in their descent, they use a large stone of red granite, having the smaller end bored so as to admit a rope, which is rove through it. When about to dive, the diver seizes this rope with the toes of his right foot, and with the left foot secures a network bag for his oysters. He then takes hold of another rope with his hands and is let down from the boat to his diving-ground, the stone helping to sink him. When at the bottom, he casts himself loose from the stone, picks up his oysters, and when ready to return, jerks the rope by which he was let down, and he is then hauled up, leaving the stone to be recovered by its own rope. The chief danger the divers have to encounter, after the preliminary physical difficulties attendant upon diving and working at so great a depth have been got over, is from ground-sharks. The divers in the Persian Gulf are wont to resort to magic and to religious enchantments in the hope of guarding against these horrible creatures; but as an additional and more effectual precaution, they are armed with a short stick, pointed at either end, which they thrust into the shark's mouth, they themselves getting away while the monster is engaged in fretting over his uncomfortable, indigestible meal. A story is related of one diver who, having explored a rock on which he expected to find oysters, was about to return "where he could see the stars again," when, casting his eye upward, he saw a huge ground-shark lying in wait for him, and cutting off his retreat. Terrified at the sight, and unable to get out of range, he was beginning to give himself up for lost, when a happy thought occurred to him. He took his sharpened stake, which was too small to stop the jaws of the shark, and going to a sandy nook of the rock began to stir up the mud, and to make such "a dust in the water" as to obscure the enemy's vision. Having done this till he was forced to quit for lack of breath, he swam off hastily in another direction, and arrived at the surface exhausted but in safety. At the top he was rescued by the boat in attendance, and the shark, befooled at the bottom of the water, was left to gnash his teeth in vain.

Some of the divers are armed with a long knife, which they use not only as a defence against marine assailants, but for the purpose of detaching tenacious oysters, many of which, especially they of the strong *byssus* or moorings, adhere to the rock with a grip requiring great strength to overcome it. The diver having been pulled into the boat with his net full of oysters and mussels, the booty is taken on shore, and "as soon as the oysters are taken out of the boats, they are carried (in Ceylon) by the different people to whom they belong, and placed in holes dug in the ground to the depth of about two feet, or in small, square, hollow places cleared and fenced round for the purpose, each person having his own separate division. . . . As soon as they have passed through a state of putrefaction and have become dry, they are easily opened, without any danger of injuring the pearls, which might be the case if they were opened fresh, as at that time to do so requires great force. On the shell being opened the oyster is minutely examined for the pearls; it is usual even to boil the oyster itself, as the pearl is not unfrequently found actually embedded in the body of the fish."

WONDERFUL APPLICATION OF HEAT.

EXPERIMENT (remarks Baron Liebig) has shown that a quantity of heat, sufficient to raise a pound of water one degree of temperature, will, when communicated to a bar of iron, enable it to elevate a weight of 1,350 lbs. to the height of one foot. An interesting application of this fact was long ago made in the Conservatoire des Arts et Métiers, in Paris. In this building, which was formerly a convent, the nave of the church was converted into a museum for industrial products, machines, and implements. In its arch, traversing its length, appeared a crack, which gradually increased to the width of several inches, and permitted the passage of rain or snow. The opening could easily have been closed by stone and lime, but the yielding of the side walls would not have been prevented by these means. The whole building was on the point of being pulled down, when a natural philosopher proposed the following plan, by which the object was accomplished:—A number of strong iron rods were firmly fixed at one end to a side wall of the nave, and after passing through the opposite wall, were provided on the outside with large nuts, which were screwed up tightly to the wall. By applying burning straw to the rods they expanded in length. The nuts by this extension being now removed several inches from the wall, were again screwed tight to it. The rods on cooling contracted with enormous force, and made the side walls approach each other. By repeating the operation the crack entirely disappeared. This building, with its retaining rods, is still in existence.

THE SNAKE-CHARMERS OF INDIA.

SNAKE-CHARMING is a very ancient art, having been practised in many Eastern countries from a remote antiquity. We find occasional allusions to it in the Old Testament, as well as in classic writers. But it is in India that the art of snake-charming has attained the highest degree of success, its secrets being so well handed down that it is commonly practised by the Hindoos at the present day.

The Indian snake-charmers wander from village to village, and from town to town, with their snakes carried in baskets. They exhibit their skill chiefly for the amusement of the people, but often turn it to useful account in luring dangerous serpents from their lurking-places in houses, banks, or old walls. The chief agency in the charm is music, and this of the most indifferent kind, consisting of dismal tunes slowly played on a pipe something like a flageolet. The Hindoo conjurer affects also to exercise a spell on the reptiles by means of the voice alone, but this is believed to have no foundation in fact.

The mode of exhibition by the snake-charmer is usually the following:—Setting down his basket of snakes, which has been covered with cotton wool, he produces his pipe, and performs upon it a few droning notes. The snakes come out from the basket upon the ground, and as the juggler continues playing, seem much delighted, erecting themselves about half their length from the ground, and keeping time by graceful undulatory motions of the head and neck. At times twenty of the serpents may be seen thus dancing together, with hundreds of natives looking on. After the dancing has continued some time, the juggler, seizing one or more of the snakes, will coil them round his head and neck, playing with them fearlessly, and apparently having them under his entire control.

The snakes which generally form the subject of exhibition, are the kind most dreaded of all—the cobra di capello. It has often been supposed that before the juggler exhibits his snakes he has carefully extracted the poison-fangs, and hence that his tricks, daring as they sometimes are, may be performed in perfect safety. This, however, is not always the case. Cobras from which the fangs have been drawn are frequently among the snakes which the charmers carry, but it has been proved again and again that in many of them the venomous powers are still unimpaired. The possession or the abstraction of these powers does not affect the peculiar sensibility of the snakes to the influence of the monotonous music of the Hindoo pipes; and in this undoubted susceptibility consists the secret of the power and control of the conjurer over the reptiles.

Many fatal accidents have arisen from persons having vainly imagined that the jugglers' snakes have been rendered harmless. Forbes, the author of "Oriental Memoirs," thus relates his own narrow escape:—"Among my drawings is that of a cobra di capello, which danced for an hour on the table while I painted it. I frequently handled it, to observe the beauty of its spots, and especially the spectacles on the hood, not doubting that its fangs had been previously extracted. But the next morning my upper-servant, a devout Mussulman, came to me in great haste and desired I would instantly retire and praise the Almighty for my good fortune. Not understanding his meaning, I told him that I had already performed my devotions. Mahomet then informed me that, while purchasing some fruit in the bazaar, he saw the man who had been with me on the preceding evening entertaining the country people with his dancing-snakes. The peasants, according to the usual custom, sat on the ground round the charmer, when, either from the music stopping too suddenly, or from some other cause of irritation, the vicious reptile, which I had so often handled, darted at the throat of

a young woman, and inflicted a wound of which she died in about half an hour."

The fact that a cobra may frequently be handled with impunity, as in the case of Mr. Forbes, is well known, and many of our readers will recall to mind the case of a keeper at the Zoological Gardens in the Regent's Park, who was in the habit of playing with the snakes, but at last lost his life from the bite of one of the reptiles. But, as a writer in the "Oriental Annual" observes, it is a remarkable peculiarity in the cobra di capello, and in most poisonous reptiles of this class, that they seem to have a great reluctance to put into operation the deadly powers with which they are endowed. The cobra scarcely ever bites unless excited by actual injury or extreme provocation; and even then, before it darts upon its aggressor, it always gives him timely notice of his danger in a way not to be mistaken. It dilates the crest upon its neck—a large flexible membrane, having on the upper surface two black circular spots, like a pair of spectacles; it waves its head to and fro with a gentle undulatory motion, the eye sparkling with intense lustre, and commences a hiss so loud as to be heard at a considerable distance—so that the juggler always has warning when it is perilous to approach his captive. The snake never bites while the hood is closed; and so long as this is not erected, it may be approached and handled with impunity. Even when the hood is spread, while the creature continues silent there is no danger. Its fearful hiss is at once the signal of aggression and of peril.

Though the cobra is so deadly when under excitement, it is appeased with astonishing rapidity even from the highest state of exasperation, merely by the droning music of the juggler's pipe.

THE CORONATION STONE AT KINGSTON.

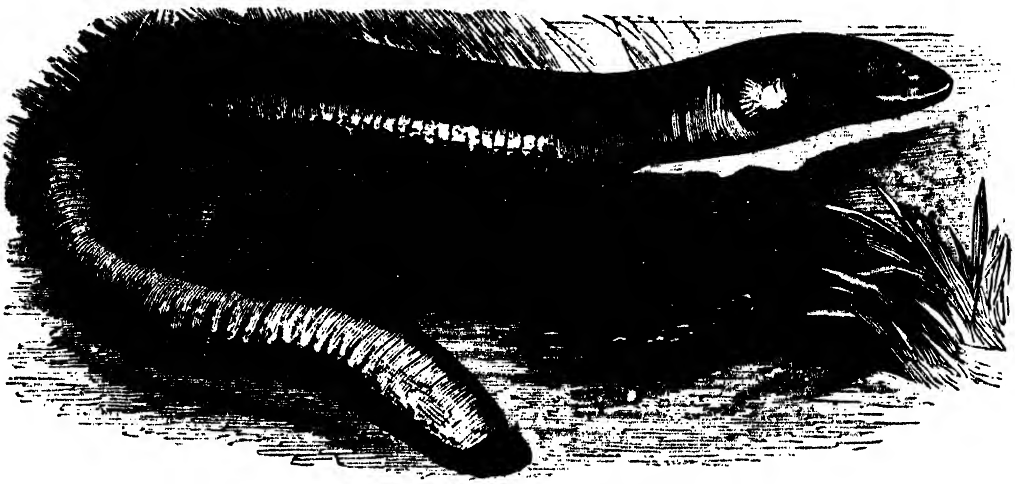
SOME years back, a visitor to Kingston-on-Thames might have seen lying in an ignominious position near the Town Hall, a large square block of stone, which was generally used for the purpose of a stepping-stone to enable the goodwives of the town to mount their horses. Tradition asserts, however, that some ten centuries back this identical stone was the stepping-stone to the throne of England itself. No one could have supposed that this rude, almost shapeless, and uncared-for mass of stone was hallowed by historical associations of deep and enduring interest to Englishmen, and that upon it no less than seven of our Anglo-Saxon sovereigns knelt and were anointed to the kingly dignity. Yet such, we are assured, was the fact, and the names of the monarchs were Edward the Elder, son of the Great Alfred, Athelstan, Edmund, Etheldred, Edred, Edwy, and Edward the Martyr. After lying in this position for ages, the people of Kingston, in the year 1850, resolved that this interesting relic should be rescued from further desecration, and preserved as a monument of the times when the constitution and the laws of our country had their birth. A neat and substantial monument, enclosed by handsome iron railings, was therefore erected in front of the Court House and facing the Town Hall, the stone was elevated to the summit, and its inauguration as the "Kingston Coronation Stone" was celebrated on the 19th of September, 1850, with much rejoicing.

THE ELECTRICAL EEL.

THE gymnotus, or electrical eel, is rather more serpentine in form than the common eel, and frequently attains a great size. It is found in the rivers and marshes of South America, where the natives fish for it in a singular manner. M. Bonpland describes a scene witnessed by him in one of the marshy pools of Venezuela. About thirty horses and mules were driven into the water by a number of Indians, who, armed with long canes and harpoons, prevented them from returning to the banks until the object of the *battue* was attained. The trampling of the horses and the shouts of the Indians soon produced a scene of wild excitement. Writhing on the surface of the water, and gliding under the bellies of the animals, the gymnoti discharged through them repeated shocks from their electric batteries, while the poor bewildered brutes, convulsed and terrified, their manes erect, and their eyes staring with pain and anguish, made unavailing efforts to escape. The eels, from four to six feet in length, and livid in colour, had the appearance of great water serpents, and one in particular was observed which discharged the whole power of its battery along the belly of a horse. In less than a quarter of an hour the electrical energy of the eels became exhausted, and though some of the horses and mules had been benumbed and drowned, the greater number scrambled ashore and recovered. The eels in their exhausted state were easily captured.

The extraordinary power of the gymnotus was placed beyond doubt a few years ago, when living specimens of this fish were exhibited in the Adelaide Gallery and the Polytechnic Institution. The illustrious Faraday took the opportunity of experimenting upon it, and established to his own satisfaction the identity of its peculiar power with that of voltaic electricity of peculiar intensity. The eel he experimented with was only forty inches long, yet it produced a succession of shocks at short intervals, affected the galvanometer, and imparted magnetism to iron.

The diagram (Fig. 1) shows the gymnotus lying with its belly turned a little on one side towards the eye. The mouth is shown at *a*, a portion of the skin turned back at *b b*. The ventral fin is marked *c c*, and the fin-muscles *d d*. The electrical organs (for there are two pairs, a larger and a



THE GYMNOTUS, OR ELECTRICAL EEL.

smaller) range along the whole body, from the head to the tail, as shown by the blank spaces. The appearance they present to the eye is shown by the lines *e e* and *f f* (Fig. 2). These are to some extent parallel with the axis of the body, and represent the thin membranes of which the organs are composed. They occupy nearly half the thickness of the body, and one pair is placed on either side of the spinal column. At the end near the head the electricity is positive, at the other end negative. The full power of the battery is elicited when a connection is made between the head and the tail, the effect being diminished in any intermediate part, precisely as in a voltaic battery. Professor Faraday having put a few small live fish into the water with the gymnotus, the latter formed itself into a circle, enclosing the fish by joining its head to its tail, and sent a shock through the water which instantly stunned its prey. When the hand was held in the water whilst the charge was transmitted, a shock was felt, though not so strong as when the eel was touched at its two extremities. It may sometimes happen, when the gymnotus is seriously wounded by the fishing operations which we have described, that it gives a very weak shock on being touched. If, however, presuming too much on its exhaustion, the fisherman handles it fearlessly, its shock is more severe than usual—one of the many proofs which might be cited that the discharge depends upon the animal's will. No muscular movement is observed with the shock.

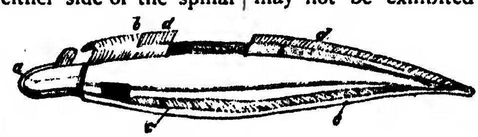


Fig. 1.

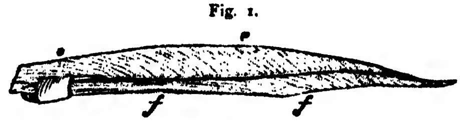


Fig. 2.

The facts we have recited sufficiently demonstrate to our minds that there is an intimate relation between nerve-power and electricity, in spite of all that may be said as to the purely chemical origin of this power in animals. In fact, it is not yet in the power of any physiologist to say with certainty through what organ the effects of animal electricity may not be exhibited under certain conditions of mind and body. Dr. Golding Bird states, in his "Elements of Natural Philosophy," that "the human body is always in an electric state, though of the feeblest tension, never exceeding that evolved by the contact of a plate of zinc with a plate of copper;" and that "it increases with the irritability of the person, appearing to be greater in the evening than in the morning, and disappearing altogether in very cold weather." The science of animal magnetism is but an expression of belief in this natural fact, and in the power of the will to control the phenomena. This is a subject, however, upon which it will not be convenient at present to enter, though there can be little doubt that it stands in direct relationship with the wonders of animal electricity. It may be added that the gymnotus is not the only inhabitant of the water that possesses this property.

A STORY OF A DIAMOND.

THE diamond has always enjoyed an undisputed pre-eminence among precious stones, not only on account of its rarity, but also from its unequalled brilliancy. Some of these stones have been sold for almost fabulous prices, and many of the most celebrated diamonds known to exist have changed hands from time to time under strange and romantic circumstances.

Among the jewels formerly in the regalia of England was a diamond of great beauty and value, with which is connected a very remarkable history. It was once the property of Charles the Bold, last Duke of Burgundy, who wore it in his hat at the battle of Nancy, in which he lost his life.

The diamond was found on the field after the battle by a Swiss, who sold it to a priest for a trifle, and it afterwards became the property of a French nobleman named De Sancy. The treasure remained in the possession of his family for more than a century, when one of his descendants, who was captain of the Swiss guard under Henry III. of France, was commissioned by the king to raise a new force from the same nation. Henry at length found himself unable to pay his soldiers, and in this emergency he borrowed the diamond from the Count de Sancy, that he might place it in the hands of the Swiss government as a pledge for the fulfilment of his engagements.

The count entrusted the diamond to one of his most faithful followers for conveyance to the king; but the messenger and the treasure disappeared, to the great consternation both of Henry and De Sancy. The most diligent search was made, but without furnishing any clue to the mystery. So strong was De Sancy's confidence in the perfect probity of his servant, that he felt convinced some misfortune must have happened to him; and he persevered in his inquiries, until he at length discovered that his follower had been waylaid and murdered by a band of robbers, and the body concealed in a neighbouring forest.

De Sancy ascertained the locality, and instituted a careful search, which resulted in the discovery of his messenger's remains. He next gave directions to have the body opened; when, to the astonishment of all but De Sancy himself, the treasure was discovered. It was now clear that the poor fellow, on finding himself beset beyond the possibility of escape, had swallowed the diamond rather than that it should fall into the hands of the robbers. The story has been commemorated in the appellation the diamond has ever since borne of "the Sancy."

The diamond was purchased for the Crown of England; but James II. carried it with him in his flight to France in 1688. Louis XV. is said to have worn it at his coronation. In 1835 it was purchased by a Russian nobleman for £80,000.

THE ATLANTIC TELEGRAPH.

THERE is nothing difficult, now that the thing is an accomplished fact, in grasping the idea that cables more than 2,000 miles in length lie underneath the Atlantic, joining together, by unbroken cords, the Old World and the New. The real wonder of the first Atlantic cable consisted in the gigantic scale on which it had to be carried out in every detail. The thing itself was not a novelty.

The longest telegraphic conductor that had previously been submerged was that between Varna and Balaklava, which had been hurriedly put down to meet the exigencies of the Crimean War. The length of this was 360 miles, of which only twelve were really *cable*, the remainder being simply copper wire covered with gutta-percha, and the longest cable previous to 1858 had been only 123 miles in length; while the Atlantic cable was to be twenty times this length, was to be laid in water two miles deep, and was to cost nearly £400,000.

The "conductor" of this cable—that is, the part which conveys or *conducts* the electric currents—consisted of seven small copper wires twisted together, the object of this being that if one of the wires broke, others might yet remain uninjured to keep up the continuity.

To protect this conductor from contact with the water—which, being itself a conductor of electricity, would, if it touched the copper, allow the electric current sent into the wire to escape and return to its source before it had traversed the entire length—it was entirely enveloped in gutta-percha.

The soft gutta-percha had, however, to be carefully protected from external injury, for upon its integrity depended the success of the undertaking. To effect this, it was first well wrapped with jute yarn, saturated with a compound of tar, pitch, linseed oil, and beeswax, and laid over this was the outer covering of iron. This covering consisted of eighteen strands twisted spirally round the jute, each strand composed of seven small iron wires. The weight of the finished cable was a ton a mile, and 3,000 miles were stowed on board the two cable-ships, the *Niagara* and *Agamemnon*, at one time, each ship carrying 1,500 tons.

The vessels sailed from Valentia on the 7th of August, 1857; and all went well until 385 miles had been paid out, the depth of water reached being rather over two and a quarter miles; when a sudden rise of the ship's stern, and a want of care in releasing the "break," caused the cable to snap, and put an end to all further attempts for that year.

An additional length of nearly 900 miles was made, to compensate for that already lost, and to be in readiness to supply the room of any future losses. The risk which would attend making the splice between the two halves of the cable in mid-ocean—one end, supporting the weight of nearly

three miles, hanging over the stern of the ship—had also been carefully discussed, and it was resolved that both cable-ships should upon this next attempt proceed direct to mid-ocean, and await the opportunity of favourable weather to make the splice. This being made, the two ships would steam in opposite directions, and the cable be laid in half the time.

This was the arrangement, then, which was carried out in 1858. The vessels met in mid-ocean, the cables were united, and the "paying out" commenced; but before the two ships were fairly "hull down," the cable broke on board the *Agamemnon*. Another meeting of the ships, another splice, and another commencement of the laying followed; but before 100 miles had been laid, a stoppage of signals occurred between the two ships. In this case, the cable had broken on board neither of the ships, nor was any difference of strain indicated upon the cable; the inevitable conclusion, therefore, was that the break had occurred in the depths of the ocean, but from what cause was never known.

The vessels again met, and resolved to proceed to Cork for further instructions. These instructions were to re-coal and to proceed to sea for another attempt. The perseverance shown was upon this occasion crowned with success. The splice was made at one o'clock p.m. on July the 29th, 1858; and early on the morning of the 6th of August the Atlantic was bridged by a telegraph, from which time until half-past one o'clock p.m. on September the 1st, the cable continued intermittently in use. Altogether, 400 messages, averaging rather over ten words each, were transmitted by the first Atlantic cable.

The difficulty of working through the 1858 cable was always exceedingly great, and at length all attempts to transmit signals through it failed. Various efforts to "underrun" or to raise the cable were made, hoping the faulty part might be reached and rectified, but all to no purpose, and the entire cable was at length reluctantly abandoned.

Several years elapsed before another attempt was made to put telegraphic connection between the two continents, and the time was employed in making experiments upon the best form of cable, and the means of submerging it. In 1865 all was again ready; an improved cable 2,300 miles in length had been constructed, and the *Great Eastern*, steamship—the only suitable vessel—was employed to receive the whole of its vast bulk, in three separate coils, weighing together 4,000 tons. In July the *Great Eastern* started from Valentia, and she had proceeded about ten days on her journey, paying out considerably more than 1,000 miles of the cable, when it suddenly snapped from overstraining. Attempts were made to recover the parted end of the cable by dredging along the bottom of the ocean with powerful grapnels, but after some days had been spent in this work, and all the material available for the purpose had been exhausted, the effort was reluctantly abandoned. Careful note was taken, however, of the latitude and longitude of the spot where the cable had disappeared, and buoys were placed to mark it.

The want of success which had hitherto attended the operations did not discourage the projectors, nor prevent the public from again displaying confidence in the eventual result, by subscribing the necessary capital. By the following year another cable had been made, and the *Great Eastern* was again chartered for its submersion. On this voyage it was attended by three other vessels, the *Terrible*, the *Medway*, and the *Albany*, for it was designed not only to lay another cable, but to make every effort to recover and complete that of 1865. On the 13th of July, 1866, this expedition started from Valentia as before; and on the 27th of the same month the *Great Eastern* reached Newfoundland, having this time brought its mission to a triumphant end, by leaving a continuous cable in its track. Congratulatory measures were immediately exchanged between the two shores, and the attendant vessels then proceeded in search of the buoys which marked the spot where the 1865 cable had vanished. One of these buoys was found, although others had been carried away by the storms; and the *Great Eastern* arriving on the spot a few days afterwards, the telegraphic flotilla commenced another series of dredgings to get hold of the cable. It was hooked several times, and raised a considerable distance, but slipped down again.

At length, after the search had proceeded in this way for nearly three weeks, the end of the cable was caught and retained on the 1st of September, and the long line of more than 1,000 miles proved to remain uninjured. A splice was then made with the portion of the same cable conveyed by the expedition for that purpose, and within a week this cable also was completed.

CEREMONY AMONG SAVAGES.

DISRAELI, in his "Curiosities of Literature," has some curious remarks on the customs of different nations in their modes of salutation. The Philippine Islander, he says, in saluting a friend, takes hold of his hand or foot and rubs it on his own face. The Lapland salutation is even more peculiar; when they meet they rub their noses together. A traveller named Houtman tells us that to be polite in the islands situated in the Straits of the Sound is a matter of considerable difficulty, and then he describes his own reception: "They raised my left foot, which they passed gently over my right leg, and from thence over my face."

An Ethiopian takes the robe of another and ties

it about his own waist, so that he leaves his friend half naked. "This custom," says Disraeli, "of undressing on these occasions takes other forms: sometimes men place themselves naked before the person whom they salute, to show their humility, and that they are unworthy of appearing in his presence. This was practised before Sir Joseph Banks, when he received the visit of two people of Otaheite. The Japanese only take off a slipper, the people of Arracan their sandals in the street, and their stockings in the house."

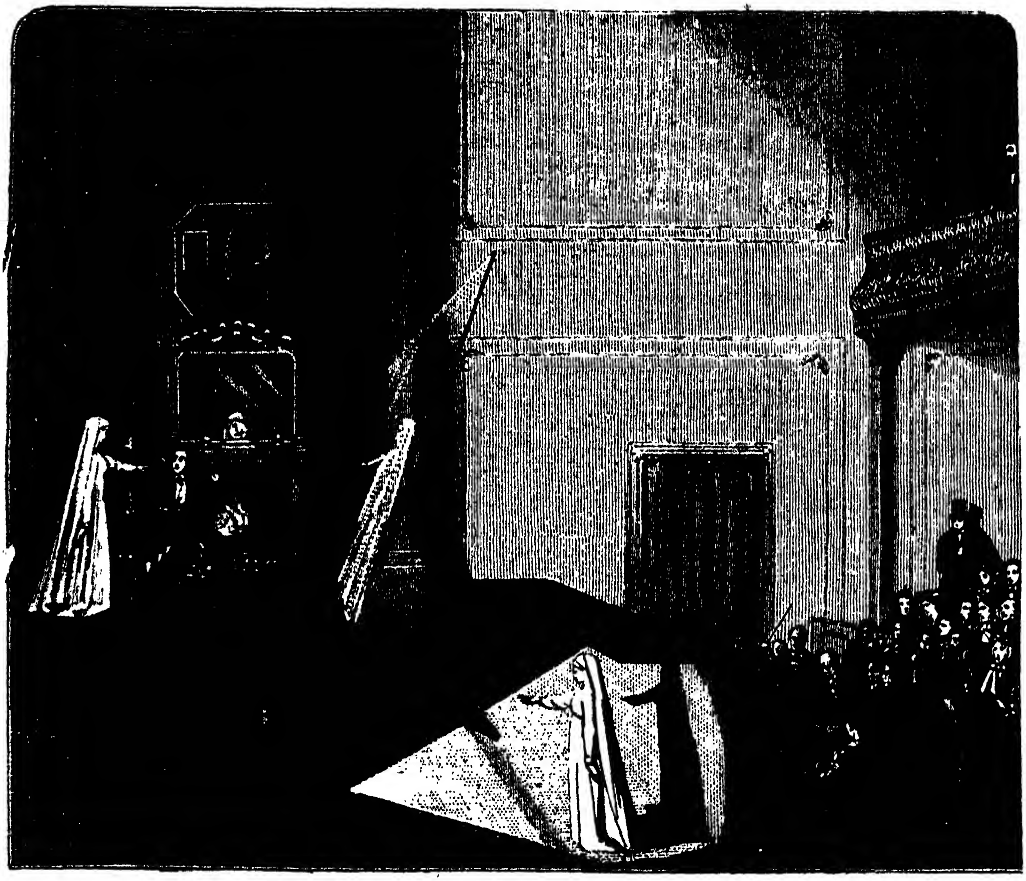
In personal civilities the Chinese surpass all nations, dealing in the most extravagant compliments and loving greetings in the market-place. If two people meet after a long separation, they both fall on their knees and bend the face to the earth, and this ceremony is repeated two or three times. Their expressions are as exaggerated as their gestures. If a Chinese is asked after his health, "Very well, thanks to your abundant felicity." If you render him a service, "My thanks shall be immortal." If you praise him, "How shall I dare to persuade myself of what you say to me?" The strangest part of the system is, that these replies are prescribed by a regular academy of compliments. There are determined the number of bows, the genuflexions, the salutations, and the gestures of the whole nation. The lower orders are as punctilious as the grandees, and ambassadors pass forty days in practice before they are allowed to appear at court.

Animal Sagacity.

Remarkable Instinct of the Martin.—For some years the writer occupied a cottage near Esher. Under the trellised porch was a martin's nest, which was repaired every season for at least three years, and from which a brood of four or five young birds took their flight year by year. The porch was covered with zinc, and the nest was built against the wall, close against the angle formed by the slanting sides of the roof. One morning, before the brood was hatched, one of the old birds was found in the porch dead, owing probably to the unusual heat of the sun shining upon the zinc covering, which was only a few inches above the nest. Opposite the porch, and separated from it by the width of the garden walk, was an arch of wire covered with roses and honeysuckles. About eleven o'clock on the morning of the day when the bird had been found dead, the writer's attention was attracted by an unusual twittering, and looking towards the porch, he observed a martin, which he presumed to be the male bird, flying in and out of the porch on to the arch, and evidently endeavouring to coax another bird into his snug quarters. After a while the second martin took several short flights, and dived under the arch along with her companion, who twittered and flew round her in a state of the greatest excitement. This continued for about half an hour, until the stranger took possession of the nest, where she finally hatched the brood.

A Camel's Revenge.—A valuable camel, working in an oil mill in Africa, was severely beaten by its driver. Perceiving that the camel had treasured up the injury, and was only waiting a favourable opportunity for revenge, he kept a strict watch upon the animal. Time passed away; the camel, perceiving that it was watched, was quiet and obedient, and the driver began to think that the beating was forgotten, when one night, after the lapse of several months, the man was sleeping on a raised platform in the mill, whilst, as is customary, the camel was stabled in a corner. Happening to awake, the driver observed by the bright moonlight that, when all was quiet, the animal looked cautiously around, rose softly, and stealing towards a spot where a bundle of clothes and a bernous, thrown carelessly on the ground, resembled a sleeping figure, cast itself with violence upon them, rolling with all its weight, and tearing them most viciously with its teeth. Satisfied that its revenge was complete, the camel was returning to its corner, when the driver sat up and spoke. At the sound of his voice, and perceiving the mistake it had made, the animal was so mortified at the failure and discovery of its scheme, that it dashed its head against the wall and died on the spot.

A Pointer's Contempt.—In proof of the dislike a pointer will show to a bad shot, Mr. Jesse adduces the following anecdote, given on reliable authority. A gentleman, on his requesting the loan of a pointer dog from a friend, was informed by him that the dog would behave very well so long as he could kill his birds; but if he frequently missed fire, it would run home and leave him. The dog was sent, and the following day was fixed for trial; but, unfortunately, his new master was a remarkably bad shot. Bird after bird rose and was fired at, but still pursued its flight untouched, till at last the pointer became careless, and often missed his game. As if seemingly willing, however, to give one chance more, he made a dead stop at a fern-bush, with his nose pointed downward, the fore-foot bent, and his tail straight and steady. In this position he remained firm till the sportsman was close to him with both barrels cocked; then, moving steadily forward for a few paces, he at last stood still near a bunch of heather, the tail expressing the anxiety of the mind by moving regularly backwards and forwards. At last out sprang a fine old blackcock. Bang! bang! went both barrels, but the bird escaped unhurt. The patience of the dog was now quite exhausted, and, instead of dropping to charge, he turned boldly round, placed his tail between his legs, gave one howl, long and loud, and set off as fast as he could to his own home.



PEPPER'S GHOST.

THE WONDERS OF LIGHT.

JUST as an india-rubber ball bounds from any surface it strikes against, so light is reflected from any object which lies in its path. Perhaps this comparison is hardly correct; for *all* the light does not rebound from the reflecting surface, but only a portion of the ray is reflected, the rest either being absorbed by the body, or, if the body be transparent, passing through it. The quantity of light which is thus reflected entirely depends on the state of the surface. Silver, for example, which admits of a very high polish, when excessively bright reflects almost all the rays which fall upon it; whereas, if its surface be dull, only very few are thrown back. Any surface which is not highly polished is really made up of innumerable small projections, which the process of polishing either lays flat or shaves off; and when a beam of light strikes such a surface, each of these projections throws back some of it, and scatters the light in a thousand ways—or, as science expresses it, the light is *dispersed.* This is the reason why you cannot see your face in a sheet of paper; the light which shines from your face reaches the paper, but instead of being thrown back regularly, as it is by a polished surface, it is scattered in every direction.

If the surface be perfectly smooth, the light which comes from any object is reflected from the surface unbroken, just as it comes from the object, and, therefore, carries an image of the object to the eye. This is the case with a looking-glass; and it will be noticed that the image is apparently just as far behind the glass as the object is really before it. This fact has been ingeniously taken advantage of to exhibit that popular wonder, Pepper's ghost. The appearance of this mysterious spectre is at once explained by our sketch. The "original" of the ghost is below the stage, highly illuminated by the oxy-hydrogen light. The reflection of this figure is thrown upon the audience by the sheet of plate glass erected on the front of the stage. This glass is invisible on account of the gloom which always surrounds the appearance of a ghost. Of

course the actor behind the glass does not see the spectre, but a warning from an accomplice tells him of the "mysterious presence." The illusion is really wonderful; but how often has the reader, sitting in the dusk of the early winter evening, before the gas was lit, seen the reflection of the fire in the window? and had he been ignorant of the existence of the glass, he well might have supposed that there was a fire in the garden.

That other wonder, which has astonished crowded audiences—"The Sphynx"—is only another illustration of this property of light. The exhibitor prepares a three-legged table, and fits two sheets of looking-glass from one leg to the other two legs—that side of the table which has no looking-glass between its legs is away from the audience. The floor of the stage is covered with green baize, and the sides and back are hung with plain red material. The audience see the reflection of the sides from the looking-glasses, and fancy they are looking under the table to the back of the stage. Of course, the owner of the head is kneeling under the table. The conjuror carefully abstains from going behind the table, or another wonder, not included in his startling programme, would be produced—that of a legless wizard!

VENETIAN GLASS.

VENICE possessed the art of glass-making almost as early as the foundation of the city itself. An immense trade in beads, imitations of pearl and precious stones, was carried on with the coasts of Asia and of Africa, and extended to India and to China. The revival of art in Italy improved the design and colours of Venice glass; her mirrors, her table-glass, of variegated colours and spiral stems, her bottles and cups, obtained high reputation, and for a time supplied the wants of Europe, Africa, and Asia. Judging from curious specimens extant, the Venetian glass-blowers must have been skilful artists. A glass Venetian knife-handle, with a coating of white transparent glass, including differently-coloured glass fused into one variegated mass, is very beautiful, and the Venetian ball is a similar specimen of ingenuity. But the white glass of Venice was far inferior in pellucid refractibility to modern English crystal glass. The finest ancient Venetian glass is rather celebrated for its lightness than crystalline beauty. The Venetians also originated the modern style of glass engraving: the first specimen was scratched with a diamond, or broken steel file, but the engravings produced by copper and lead wheels are far superior. The Venetians also revived the curious ancient art of forming mosaic glass pictures, and in the present day Venice is unrivalled for its cheap and excellent glass bugles and beads. The Venetians were celebrated for their *filagree* spirally twisted white and coloured enamel glasses, cased in transparent glass, much used in the stems of wine-glasses; *millefiore* glass—ends of fancy-coloured tubes, cut sectionally at right angles with the filagree cone, to form lozenges and tablets, massed together by transparent glass; and *vitro di trino*—fine lace-work, intersected with white enamel or transparent glass, in diamond-shaped sections, the centre of each having an air-bubble, executed almost with the precision of engine lathe-turning.

THE ITALIAN POISONERS.

THE wonderful lengths to which human nature can go in a course of deliberate and atrocious crime are nowhere more strongly exemplified than in the history of the secret poisoners of Italy and other countries. With Italy their diabolical art is more particularly identified, but, unhappily, it has not been confined to any nation or time. There are traces of its practice among the ancient Greeks, and allusions to it are frequent with the Roman writers. We are told, among other instances, that the Empress Agrippina, being determined to compass the death of Claudius, her husband, ordered an infamous woman named Locusta to procure for her a poison which should slowly consume him in mind and body, and that this was administered to him in a dish of mushrooms. Nero, the son of Agrippina, afterwards employed the same woman's agency to get rid of his relative and rival Britannicus, and not only liberally rewarded her, but gave her pupils whom she was to instruct in the processes of her fiendish art. Its secrets were but too well transmitted to after ages, for in Rome and Italy generally it appears to have been continually practised, and it prevailed enormously in the sixteenth and seventeenth centuries. The Borgias—Pope Alexander VI. and his children Cæsar and Lucrezia—will for ever be infamous for this among other crimes, and the father at last met his death through poison prepared for some of the cardinals, but partaken of both by himself and his son through the misplacing of some vessels at a banquet.

About the middle of the seventeenth century, the practice of secret poisoning reached its height in Rome. It became the subject of common remark that great numbers of husbands died shortly after marriage, and the clergy, who were in the constant habit of hearing confessions, made known to the government the fearful prevalence of the crime of poisoning, although without betraying the names of individual criminals. A careful search was made to discover the prime movers in the matter, and attention was drawn to a society of young married women who were in the habit of meeting at the house of an old "fortune-teller" named Hieronyma Spara. A woman was engaged to visit this house in the guise of a lady of rank, and by her means it

was discovered that Spara was a preparer and seller of poisons, and that large numbers of the women of Rome were in her confidence. Spara was put to the torture and hanged, with several of her accomplices; many were whipped through the streets, and others, of the highest rank, were heavily fined and banished.

Spara had a successor in her diabolical trade in a woman named Tophania or Tofana, who practised it extensively in the cities of Palermo and Naples. According to some writers, Spara herself had learnt it from this Tophania, who, at any rate, was second to none in the extent to which she engaged in it. She is said to have carried it on, and eluded the efforts of the police, for nearly half a century—from her very girlhood to old age. It was her practice, when in danger of arrest, to take refuge in the sanctuary of a monastery or convent, and from one of these places she was at last forced by a band of soldiers under the command of the Viceroy of Naples. Both the clergy and the people were highly indignant at this violation of what they considered the sacred right of refuge in such a holy place; but the Viceroy was firm. He produced a revulsion in the popular feeling by ordering a report to be spread that Tophania had poisoned the wells, and then had her strangled and her body thrown back into the building from which she had been taken, that the clergy might have the satisfaction of giving her burial. Being tortured before her death, she confessed to having been instrumental in the poisoning of 600 persons.

The liquid sold by this woman in small phials was known as *aqua Tophania;* a few drops were sufficient to kill a man, and its strength was so regulated that death might be produced from its effects either instantaneously, or at any interval, from days to months. It was colourless and tasteless, and gave rise to no suspicion on administration. All the phials of the *aqua* bore the inscription, "Manna of St. Nicholas of Bari," with an image of the saint. From the tomb of this saint the people believed that there exuded at times an oil of miraculous power, and the deadly phials were therefore held too sacred for examination, even when they passed through the hands of the officers of the customs.

In the time of Tophania, as well as previously, to such an awful extent did slow poisoning prevail, that it was a very common practice for ladies to keep on their toilet-tables, among their scent-bottles, &c., a phial of this fatal mixture, the qualities and design of which were known only to themselves.

The arts of the Italian poisoners were transmitted to France, where also they were so largely practised that Madame de Sevigné expressed her belief that Frenchmen and poisoners would become synonymous terms. The case of the greatest notoriety in that country was that of the Marchioness Brinvilliers, a young and profligate woman, who was taught the art of poisoning by an officer named Sainte Croix. He himself had learnt it from an Italian while in prison with him in the Bastile, where he had been placed by the influence of the father of the marchioness. This wicked woman set to work in the most deliberate way to make herself an adept in the science, experimenting on animals, and then on the sick in the hospitals, whom she visited under the guise of charity. The firstfruits of her diabolical skill were shown in the poisoning of her father and her brothers. She then extended her practice to any one against whom she entertained a dislike, or by whose death she or her accomplice might hope to reap advantage. To some of their preparations they gave the name of "succession powder," meaning a powder to promote the succession to an estate. The marchioness attempted to poison her husband, but Sainte Croix secretly gave him antidotes to preserve him! Their crimes were at last revealed by a singular accident, which seemed like a providential retribution.

Sainte Croix, while preparing his poisons, was in the habit of wearing a glass mask, to protect himself against their deadly fumes. One day, having been probably less careful in affixing it than usual, this guard dropped from his face, and he was found suffocated in his laboratory. The Government, obtaining information of his death, caused his effects to be searched, and there was found among them a box addressed to the marchioness, with a letter affixed to it, urgently requesting that if it could not be delivered to her it should be burnt. This was sufficient to excite curiosity; the box was opened, and in it were found prepared poisons of every conceivable kind and degree of strength, all labelled with their effects as proved by actual experiment.

A servant who came forward to claim his master's goods was arrested and put to torture; he confessed a full knowledge of the crimes which had been so long unsuspected, and was sentenced to be broken upon the wheel. The marchioness escaped to England, and, after a stay of three years in this country, went to a convent in Liège; but an officer pursued her in the disguise of an abbé, obtained admittance and an interview with the fugitive, and so far gained her confidence as to prevail upon her to leave the convent walls on an excursion. When clear of the sanctuary, he made himself known and arrested her. Among her effects in the convent was found a paper containing a complete catalogue of her crimes, which included the confession that she had set fire to houses, as well as caused the death of a large number of persons by poison. But she denied everything when she was placed on her trial in Paris. She was found guilty upon overwhelming evidence, and was sentenced to be drawn through the streets upon a hurdle, with a rope

round her neck, to the Cathedral of Nôtre Dame, and afterwards to be beheaded, her body burned, and her ashes scattered to the winds. This sentence was carried into effect; but some of the people sought her ashes, and preserved them as those of a saint!

Notwithstanding this terrible example, secret poisoning continued to prevail in France, and a secret tribunal, known as the *Chambre ardente*, or Fiery Chamber, was appointed, in 1679, to search out the poison-dealers and their followers. Two of the dealers, both women, were discovered and burnt alive, and several of their accomplices were hanged or otherwise punished, those of the highest rank generally escaping after a brief imprisonment.

THE FIRE SYRINGE.

ALL things differ in their capabilities of containing heat. Any one may easily satisfy himself of this fact by putting two jars of different liquids, say water and quicksilver, at the same distance before the same fire for the same length of time. If now the experimenter dip his finger into the jars, he will find that the quicksilver is very much hotter than the water. How is this? for the same quantity of heat has entered each liquid. The secret is, that the water is more capable of containing heat than the quicksilver. Just as if a few drops of water fell on a sponge and some on the floor: in the latter case the water would lie on the surface, and be easily seen; in the former the sponge would absorb it, and not even appear damp. Thus we should say the sponge had a greater "capacity" for water than the floor.

The *specific heat* of water, as this capacity for containing heat is scientifically termed, is greater than that of any other substance—a wonderful provision; for, when we consider the vast surface of water which is exposed to the rays of the sun, we shall see that the ocean acts as a great reservoir of heat, and equalises the temperature of the climates of countries which bound its waters.

Where the sea is very distant, as in the centre of continents, the extremes of temperature are very great. In the centre of Africa the cold in the night freezes the pools of water; while the sun in the day absolutely scorches the face of the earth.

Bodies under altered circumstances have different powers of containing heat. This is the case with gases especially. When they are compressed they cannot contain so much heat as when more rarefied. It is chiefly due to this fact that the tops of high mountains are covered with eternal snow. The air is very rarefied, and as the rays of the sun stream through it, its temperature is raised but very little; hence the cold of those regions. The reader may have noticed that, when a bottle of champagne or of soda-water is uncorked a white smoke issues out of the bottle. The unlearned are accustomed to pronounce this to be carbonic acid gas, but unfortunately such gas is quite invisible. The true explanation of the wonder is that the air and gas between the cork and the liquid is in a state of great compression. The moment the cork is blown out the air expands: when it was compressed it had a certain temperature; and now, when rarefied, having acquired a greater capacity for heat, it absorbs the heat instead of throwing it out; or, in other words, its temperature falls. Now, having been in contact with water, it is full of moisture, which this sudden fall of temperature condenses. This white smoke, therefore, is a little cloud of mist.

The fire syringe shows the very opposite effect. It is a tube of strong glass, or of brass, stopped at one end, in which an air-tight piston moves. The end of this piston is hollow, so that a little piece of tinder or amadou may be placed in it. When the piston is suddenly forced down, the air, being compressed, has its capacity for heat lessened, and therefore is compelled to give out that which it contained, and so the tinder is ignited.

Doubtless on this principle may be explained the frequent accidents which have happened by the exploding of gun-cotton when rammed into a gun.

THE DIONÆA, OR VENUS' FLY-TRAP.

FLY-TRAPS are well known in the animal kingdom to every one who has eyes, or at least who uses them. The delicate web of the spider, and the deeply cut and broad mouth of the swallow, at once suggest themselves as illustrations from among our British animals. The spider, sitting at home at ease, waits the entanglement of his prey in his stake-nets, while the swallow opens his large sweep-net, and, dashing through myriads of May-flies or clouds of midges, secures hundreds of them. Both animals thus obtain their food; and other singular fly-traps could be enumerated from the animal kingdom equally well adapted to supply the necessities of their different owners. But that a vegetable should have an exquisitely constructed and perfect apparatus of this kind is very remarkable, when it is remembered that plants differ very markedly from animals in regard to their food. For, while animals live on organised substances—that is, on plants or other animals—vegetables live on inorganic substances, and a plant or an animal is of use to a living vegetable only when by decay it is resolved into its inorganic constituents. It is, then, unlikely that a fly could supply a plant with food, and yet a more perfect fly-trap than the leaves of the dionæa cannot be imagined.

This little plant is a native of the sandy bogs in the pine barrens of Carolina, in the United States.

THE DIONÆA.

It grows to a height of from six to twelve inches, producing a loose head of large whitish flowers, not unlike the flower of the Lady's Smock, so common in English meadows. The flower-stalk rises from a rosette of yellowish-green leaves, spreading on the ground. Each leaf is divided by a deep incision into two portions, the lower being a broadly-winged footstalk, and the upper the blade or true leaf itself. This upper portion is the fly-trap—the most curious part of the plant—and demands a careful description. It is roundish, and divided into two equal parts by a strong mid-rib. The margins are fringed with a row of strong spiny bristles, so that it may be likened to two upper eyelids joined at their bases. The leaf is a little hollow on either side of the mid-rib, the upper surface is dotted with minute reddish glands, and each hollow is furnished with three slender bristles. The sensitiveness of the leaf chiefly resides in these bristles. If an insect alights on the leaf, and touches one or more of them, the sides suddenly close with a force so great as to imprison the little creature, notwithstanding all its efforts to escape. The fringe of bristles on the opposite sides of the leaf interlace like the fingers of the two hands clasped together, or like the teeth of a steel trap. The insect is not crushed or suddenly destroyed, but is retained firmly imprisoned until it ceases to move, which would generally mean until it was dead, and then the leaf slowly expands. Curtis, in his interesting account of the plant, says he has "often liberated captive flies and spiders, which sped away as fast as fear or joy could hasten them."

The first description given in England of this curious plant was by Ellis, who formed a somewhat fanciful notion of the functions of the different parts of the leaf. The minute red glands, appearing, when magnified, like "compressed arbutus berries," were the bait scattered over its upper surface, which "perhaps discharge sweet liquor, and so tempt the unhappy insect to taste them. The instant these tender parts are touched by its feet the two lobes rise up, grasp it fast, lock the rows of spines together, and squeeze it to death; and, further, lest the strong efforts for life in the creature thus taken should serve to disengage it, three small erect spines are fixed in the middle of each lobe, that effectually put an end to all its struggles." The illustration which we give of this singular plant will serve to show the reader more plainly the action of the "fly-trap."

The two lobes are enfolded at night, but spread open in the day. When the bristles are irritated by man, the leaf quickly closes, remains closed for a short time, then slowly expands ready to close again if newly irritated. But if it be caused to make repeated efforts at short intervals, its movements become languid, or the sensibility is altogether exhausted, and is recovered only by a period of repose.

FIERY DRAGONS.

AMONG the most marvellous physical phenomena must be included the Fiery Dragons, or Fiery Drakes, which, at very remote periods, have been observed in the heavens. They have been so called from their fancied resemblance to the supposed dragon and serpent. The drake was originally called a "brenning" or "dipsas." Reference is made to this reptile in Drayton's "Nymphidia :"

> "By the hissing of the snake,
> The rustling of the *fire-drake*."

And again in the tragedy of "Cæsar and Pompey" (A.D. 1607) allusion is made thereto :—

> "So have I seen a *fire-drake* glide along
> Before a dying man, to point his grave,
> And in it stick and hide."

These fire-drakes, however, must not be confounded with the "ignus fatuus," or "will-o'-the-wisp," which manifestation is of common occurrence, nor with that "light o'er graves" to which the Irish poet refers in his "Melodies."

In the year 1532 flying dragons were seen in various countries—and possibly for the first time—"flying by flocks or companies in the ayre, having swines' snowtes ; and sometimes were there seene foure hundred flying togithir." So remarks the author of the "Contemplation of Mysteries" (published during the reign of Queen Elizabeth), who, oddly enough, ascribes this wonder to the "pollicie of devils and inchantments of the wicked." The following is his quaint description of this remarkable phenomenon :—"The flying dragon is when a fume kindled appeereth bended, and is in the middle wrythed like the belly of a dragon ; but in the fore part, for the narrownesse, it representeth the figure of the neck, from whence the sparkes are breathed or forced forth with the same breathing."

In a singular book printed in London in the year 1704, entitled, "A Wonderful History of all the Storms, Hurricanes, Earthquakes, &c.," there is an account of "fiery dragons and fiery drakes appearing in the air." These strange, and indeed startling sights, have appeared under certain peculiar and favourable conditions of the atmosphere, and, philosophically considered, are easily and satisfactorily accounted for. When vapours of an inflammable kind collected in the air and ascended to a cold region, the vehement agitation thereby produced induced a flame. The highest part, being more subtle, assumed the singular form of what was presumed to be the dragon's neck, and then, having been made crooked by the repulse it received, formed the dragon's belly, while the hind part, turned upwards by the force of the same collision, represented the monster's tail. Then, with impetuous motion, it fled through the heavens—all ablaze, as it were—striking deadly terror into the hearts of the ignorant and superstitious.

Blout thus observes of this astronomical marvel: "There is a fire sometimes seen flying in the night like a dragon ; it is called a fire-drake. Common people think it is a spirit that keeps some treasure hid, but philosophers affirm it to be a great unequal exhalation inflamed between two clouds—the one hot, the other cold (which is the reason why it smokes) ; the middle part whereof, according to the proportion of the hot cloud, being greater than the rest, makes it seem like a belly, and both ends like a head and tail."

In the "Statistical Account of Scotland," published in Edinburgh A.D. 1793, we are informed that rare appearances were noticed in the air about the end of November and the beginning of December, 1792. The country people called these very uncommon sights by the appellation of "dragons." They had "a red fiery colour," we are told ; appeared first in the north, and then flew rapidly in an easterly direction. Many people regarded such phenomena with terror, whilst others considered that they were the sure harbingers of fierce winds and boisterous weather, and their suppositions proved correct.

MEN WITH TAILS.

COLONEL DU CORRET, a French traveller, in a report to the French Academy of Science, gave the following account of his inquiries into the existence of such a race, which has been often questioned :—

"I inhabited Mecca in 1842, and being often at the house of an Emir with whom I was intimate, I spoke to him of the Ghilane race, and told him how much the Europeans doubted of the existence of men with tails—the vertebral column elongated externally. In order to convince me of the reality of the species, the Emir ordered before me one of his slaves, called Bellal, who was about thirty years old, who had a tail, and who belonged to this tribe. On surveying this man, I was thoroughly convinced. He spoke Arabic well, and appeared rather intelligent.

"He told me that in his country, far beyond the Sennaar, they spoke a different language ; that of his compatriots, whom he estimated at 30,000 or 40,000, some worshipped the sun, moon, and stars ; others the serpent, and the sources of an immense river, in which they immolated their victims—probably the sources of the Nile ; that they ate with delight raw flesh, and that human flesh was their favourite food. This Ghilane had become a devout Mussulman, and had lived fifteen years in the Holy City.

"Bellal was thin, but nervous and strong. His skin was black-bronzed, shining, and soft to the touch like velvet. His feet were long and flat ; his

arms and legs appeared feeble, but well supplied with muscles; his ribs could easily be counted. His face was repulsively ugly: his mouth was enormous; his lips thick; his teeth strong, sharp, and very white; his nose broad and flat; his ears long and deformed; his forehead low and very receding; his hair not very woolly or thick, but nevertheless curly. He had no beard, and his body was not hairy. He was very active and hardy; his height was about five feet. His tail was more than three inches long, and almost as flexible as that of a monkey. His disposition, setting aside oddities in taste and habits, was good; and his fidelity to his master was beyond all praise."

THE ARABIAN HORSE.

It is only (says Colonel Chesney) in Arabia that the horse is found in a state bordering upon perfection. Here he is remarkable for a small head with pointed ears, peculiarly clean muscular limbs, a corresponding delicate slender shape, rather small size, and large animated eyes, expressing that intelligence which, as in the dog, is the consequence of being constantly with the members of his master's family—in fact, he generally shares their meals. He is frequently allowed to frolic through the camp like a dog; and at other times he is piqueted at the entrance of the tent. He is exposed to the weather at all times; and, compared to the treatment of his species in Europe, he is scantily fed. A meal after sunset, consisting of barley in some parts of the country, and camel's milk in others, or a paste of dates and water, sometimes mixed with dried clover and other herbs, constitute his usual sustenance; but on any extraordinary exertion being required, flesh is frequently given, either raw or boiled.

The Bedawins count five noble breeds of horses, all, as they say, derived originally from Nedjid (the desert region of Arabia). Of these there are many branches; and there are other breeds which are considered secondary; while every mare of noble blood, if particularly swift and handsome, may give rise to a new stock. The catalogue of distinct breeds in the desert is therefore almost endless, and the pedigrees of individuals are verified by certificates which are handed down from father to son with infinite care; and not unfrequently they belong to more than one family; for there is often a copartnership in mares, and hence arise the difficulties attending the purchase of one. It is, however, certain that the Arab horses deteriorate when taken elsewhere, although both sire and dam may be of first-rate breeds. By the latter, and not the former, as with us, the Arabs trace the blood.

The number of horses in Arabia is comparatively few; their places, for almost every purpose in life, being supplied by camels.

SOME WONDERFUL BIRDS.

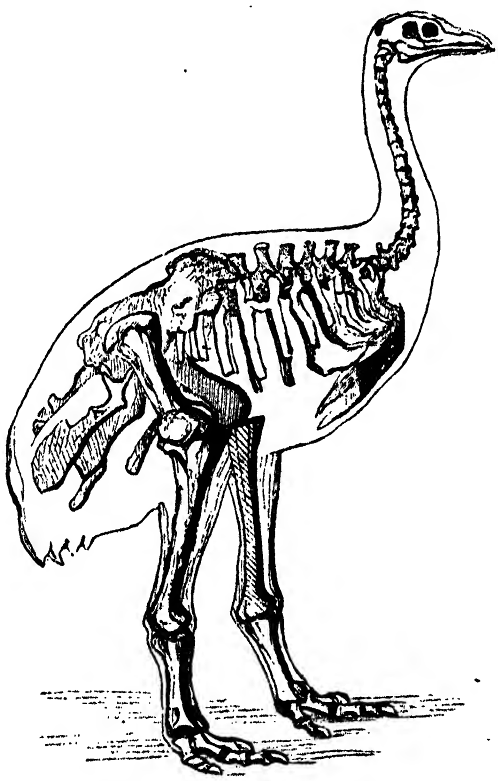
Many strange old stories, which are so improbable that they are not believed at the present time, often have some truth in them, and many have been founded on actual facts. Some great animal may have excited the wonder of savages by whom it was exterminated; they may have told the history of their hunting exploits and their dangers to their children, who, in their turn, recounted to their descendants the prowess and success of their ancestors. No tale loses by repetition, and thus a very wonderful legend often results from a very simple and ordinary account of facts. The Asiatics were particularly fond of illustrating their ancient poetry and histories with scenes in which great animals, whose forms are now unknown, played very prominent parts. One story was of such a character as to cover the great traveller Marco Polo, who brought it from India, with ridicule. But from some recent discoveries there would seem to be some truth in it. The old story is that often, when huge elephants roamed along the river side, savage rhinoceroses, impatient of their presence, rushed to attack them. The tall elephant, with its long tusks and flexible trunk, was no match for the short yet bulky rhinoceros, with a sharp horn on its snout and a skin as thick as armour. The rhinoceros was gored as it rushed between the legs of the tusk-bearing elephant, but it ripped up the stomach of its enemy with its horn. The elephant, mortally wounded, fell on the beast beneath it, and a great bird, the roc, caught both of the carcases in its talons and flew away to its haunt with them.

Several years since, some bones of a huge bird were found in the islands of Madagascar and New Zealand, and they were supposed to belong to extinct birds which were very much the same in shape; but lately some of the remains of the epiornis of Madagascar (named from the Greek for tall bird), have been studied by an anatomist, who asserts that they belonged to a gigantic bird of prey, like the condor of the Andes, or the eagle of the mountains of Europe. The great bird was at least ten feet high, and its eggs, many of which were found with the bones, are fourteen inches long. A bird of prey, with its leg-bones longer and thicker than the corresponding bones of the largest man that ever lived, and which had eggs six times the size of those of the ostrich, and 148 times the size of those of the common fowl, must have been at least many times larger than the greatest condor. If the condor and the eagle can carry off a goat or a lamb, what might not the epiornis have pounced upon and removed? The condor has a great length of wing, and swoops down from 8,000 to 10,000 feet with great velocity, and when it is attacked will give much trouble to a single man.

A condor two feet eight inches high has an expanse of wing of about 9½ feet, so that the epiornis, with his height of ten feet, would have measured thirty-seven feet from the tip of one wing to that of the other. If this new idea of the habits of the epiornis is correct, the bird may certainly have carried off ten times the weight that a condor could lift.

It is very probable, when the nature of the soil in which the bones of the epiornis have been found is considered with a view to calculate the lapse of time since it was deposited, that there is some reason to believe that the first men who emigrated to Madagascar destroyed the great bird. It is therefore probable that the great epiornis was the roc of Indian story, and that as years progressed the truth was lost sight of in the desire for the marvellous.

There are some doubts whether the epiornis was not like a huge bird whose remains are often found in the caves and bogs of the islands of New Zealand. This bird was something like a gigantic ostrich or cassowary. It had bones more like those of a beast than a bird, as regards their length and strength; and one kind had what is called the drumstick bone of the leg at least three feet in length, whilst another had a foot which covered as much space as the sole of an elephant. The bones of this great foot were as large as the toe-bones of an elephant, and the whole bird must have been about ten feet in height. It had no wings, but a long neck and a small head. The tail was short, and the legs enormously long. The feathers were very hair-like, and there was no power of flight. The bird could stalk along like a fowl, could stride over many yards, and was able to run and jump at a great pace. The huge toes were admirably suited for scraping and grubbing up the tough roots and other vegetable substances which were the food of the bird. The Dinornis, as the bird was called (from the Greek for awful or huge bird), was not a bird of prey, but a shy and fleet creature, whose strength of leg was enormous. Over-topping the tallest men, and having a long erect neck and a proud-looking head, this bird must have astonished the earliest native settlers of New Zealand, who have left many stories concerning the gigantic Moa, as they called the dinornis. It is probable that the great bird was becoming scarce when the savages first discovered and colonised New Zealand, and it is certain that it became extinct before the period of the last generation of the natives called Maories. Whilst this greatest of all running-birds has gone from off the face of the earth, a miniature of it has lived on, and is one of the wonders of New Zealand, from its long legs and bill, its hairy feathers, and its want of wings. Birds without such wings as will enable them to fly up easily, are more liable to be destroyed by men and animals than the others, and it is well known that such wingless birds existed only a short time since in the north of Europe and America, but have now disappeared. Formerly, the great auk darkened the rocks in the North Sea, but now the bird has been destroyed, and a living one has not been seen for years. The dinornis was a bird, and although so gigantic, still it was as much a bird as the tiny humming-bird, which rarely rests upon its feet, whose weight is that of a large fly, and whose wings are immense for the size of the creature, and gleam with all the colours of the rainbow. Nature adapted both of these kinds of birds for their peculiar life, and made certain parts of the body do the duty of others. The honey-sucking humming-bird is as light as the leaf of the flower it feeds upon; it flies on hour after hour, and hardly ever alights, for the honey-bearing flower would tilt over. The giant birds of old, especially those of New Zealand, had to dig up tough roots, and to get over tall ferns and low scrub. As their weight rendered flying impossible, they had to walk; hence the wingless birds were long-legged, strong-toed, and had hairy feathers.



SKELETON OF THE DINORNIS.

VIEW OF THE CAÑONS OF THE COLORADO.

A WONDERFUL COUNTRY.

On looking at a map of North America, a large river, called the Colorado of the North, will be seen to flow from the Rocky Mountains into the Gulf of California, on the western side of the continent. In one part of its course the river passes through one of the most wonderful countries in the world. There are vast plains, rising one beyond the other like enormous steps, and they extend for great distances. Range after range of cliffs, with flat table-lands upon them, are seen to stretch away as far as the eye can reach. There is hardly a tree to be seen, no grass exists, and an occasional cedar and prickly pear are the only living things in the landscape. It is burning hot by day—terribly dry and shadeless; but by night it is bitterly cold, and snow often falls. None of the wild animals which abound around the region ever come into it, and the rattlesnake and scorpion live there as the sole possessors of the soil. There is no water on the surface of the land, yet the great river and its side streams run through the country, and enormous volumes of water are constantly passing along. In this consists the chief wonder of the country, for the river has cut its way through the earth, along deep crack-like precipices, and it flows 6,000 feet below the plain. In one deep valley the river is even a mile from the surface. There are no sloping valleys, but numberless cañons, as they are called, which have

straight sides, and are generally not more than 200 feet across. At the bottom of them there is always a gloom, and they are now and then worn away into extraordinary shapes, so that, as the light changes, grand castles, great cathedrals, amphitheatres, pinnacles, and towers seem to appear and disappear. All the water which falls on to the plains above speedily makes its way down the precipices, and there are so many of them that a man may soon get lost and be constantly in danger, for they are most abrupt.

Often in the evening, when the sun is blazing red on the plains, the cañons are as dark and cold as dungeons; and when everything is dried up and arid, and travellers are dying from thirst in the burning desert above, the river is flowing all around them deep down the precipices, and is icy cold. In some seasons one may almost walk along the bed of the river, when suddenly a rush down of water occurs, and the stream rises fifty feet in a few days, and tears its way along towards the sea. All the step-like plains are cut up in the same manner, and it is a country where man can never exist for any length of time. The precipices are so numerous that the country is completely intersected by them, and any soil which may collect is either blown down them by the wind or washed into them by the natural drainage. The illustration which we give at the head of this account will enable the reader to form for himself some idea of the extraordinary character of the country, showing the plateau cut up into shreds by these gigantic chasms. If the rivers were not so deeply situated, the country might be fertile and populous; but now it is as bad as the deserts of Africa or Arabia, although water is close by.

Wonderful Instances of Courage.

ENDURANCE OF PHYSICAL PAIN.—Among the many extraordinary features in the character of Charles XII. of Sweden, not the least prominent were the entire contempt of danger he always manifested, and his complete indifference to physical pain. Of this latter characteristic a very remarkable instance is recorded by Voltaire in his well-known history of that prince's life. In the year 1709 the Swedish army, with Charles at their head, had invested the Russian town of Pultowa, now well known in history from the famous battle which a few weeks later gave so fatal a check to their victorious career. In spite of all their prowess, hitherto invincible, and Charles's untiring energy, they had failed to capture the place; while, to increase the difficulty of their task, it had lately been reinforced by the Czar in person, at the head of a large force. On the 27th of May, Charles went out to reconnoitre, and had a slight skirmish with one of the Russian outposts. In returning to the camp he was struck by a musket-ball, which ripped open his boot and broke his ankle-bone. He did not give the slightest sign of feeling the wound, and remained in the saddle for six hours after, giving his orders as coolly as if nothing had happened. At length, some one noticed that the king's boot was covered with blood, and a surgeon was at once sent for, to see the wound. By the time he came it had become so painful that Charles had to be lifted from his horse and carried to his tent. At first the surgeons were all of opinion that the only possible remedy lay in amputating the limb, until one of them, a surgeon named Neumann, declared that he was confident he could effect a cure by making deep incisions into the wound. "Go to work at once, then," cried Charles; "cut as deep as you like, and don't be afraid." The surgeon proceeded to his task, the patient holding the wounded limb in his hands, and attentively watching each incision the knife made, to all appearance as utterly indifferent to the torture he was enduring, as if the operation was being performed on somebody else.

A FATHER'S FORTITUDE.—The following incident in the native warfare of India is related by the late Sir Herbert Edwardes in his "Year in the Punjaub:"—Alladad, a native chief, being baffled in the siege of a fortress, and amazed at the failure of his well-planned measures, carried the son of the Killadar, or warden, who had fallen into his hands, before the walls, and summoned the garrison to surrender. "Give up the keys," he shouted to the warden, "or your son's head shall be cut off!" The intrepid warden replied, "If I lose my son, I can get another; but honour lost is neither to be recovered nor replaced." This noble speech is related to this day upon the border with enthusiasm and pride, but it found no echo then in the inhuman and vindictive heart of Alladad. "Strike!" he cried to the guards, and the youth's head rolled in the dust before his father's eyes. A volley from the garrison replied to this atrocious act, but Alladad escaped unscathed, and, having plundered and fired the town, retired to the hills as rapidly as he had come.

EXTRAORDINARY COOLNESS UNDER FIRE.—At the assault of Badajos, when the slaughter had been terrific, and the British had as yet been unable to effect an entrance into the town, Lieut. Shaw, of the Forty-third—afterwards Major-General Shaw Kennedy—and Captain Nicholas, of the Engineers, collecting a small body of men together, rushed up the slope of the ruins of the Santa Maria fort; but before they reached two-thirds of the ascent, nearly the whole of them were destroyed by a concentrated fire of musketry and grape. Shaw stood alone, and he was seen deliberately to pull out his watch, and, repeating the hour aloud, declare that the breach could not be carried that night.—*Napier's History of the Peninsular War.*

SAGACITY AND STRENGTH OF THE ELEPHANT.

THE enormous physical strength of the elephant is scarcely so wonderful as the extreme sagacity with which he often exercises it. At Malire, on the coast of Malabar, M. Toreen relates that he had the opportunity of witnessing a remarkable instance of this. An elephant had been hired out for a certain sum per day, and its employment was to carry with its trunk timber for a building, out of a river. This it did very dextrously under the command of a boy, laying the pieces one upon another in such exact order that a man could not have done better.

M. Phillipe saw a ship in course of construction at Goa, and at a short distance from it a number of heavy logs of wood. The men engaged in the work fastened a rope to the end of the beam that required moving, and handed the other end of the rope to an elephant, who twisted it round his trunk and dragged the timber to the ship without any conductor. One of the elephants sometimes drew beams so large that twenty men could not have moved them. What is still more surprising, when other pieces of timber lay in his way, the elephant had the sense to lift up the end of his own beam, and run it over them with the intelligence of a human being.

Some years ago two elephants, a male and female, were taken from the menagerie of the Prince of Orange, at the Hague, to Paris, to a place suitably prepared for their reception. The enclosure, formed of strong and thick beams, was in two divisions or apartments, separated by a gate. The male elephant entered first, and looked suspiciously about him. He then proceeded to examine every bar with his trunk, as if trying their solidity. They were held together by large screw-bolts, the heads of which were outside; these the elephant found out, and tried to turn the screws, but was not able. When he came to the gate between the two apartments, he soon discovered that it was only secured by an iron bar which rose perpendicularly. He raised it with his trunk, pushed up the door, and entered into the second apartment, where he found a breakfast had been prepared for him, with which he made himself quite comfortable.

From the instances of sagacity and strength already related, it may be inferred that the elephant can be trained to perform almost any suitable task in the absence of his master. M. d'Obsonville relates that he saw two elephants engaged by themselves in breaking down a wall, in accordance with orders previously received, their reward for which they well knew was to be a dessert of fruits and brandy. Their trunks were protected from injury by leather, and they had the sagacity to combine their efforts. Doubling up their trunks, they thrust against the strongest part of the wall, carefully observing and following with their eyes what effect they produced upon its equilibrium. At last, when it was sufficiently loosened, they made one violent push together, and, on their suddenly drawing back, that they might not be hurt, the wall came tumbling to the ground.

The most widely different statements have been made concerning the size of the elephant. For example, it was said that an elephant, the property of a certain Indian prince, was 14 feet high; while Mr. Corse, who relates the circumstance, judged him to be 12 feet, but was desirous of making an accurate measurement. The driver was certain it would be found 15 or 16 feet in height. When carefully measured it was found to be no more than 10 feet. There is, however, the skeleton of one at St. Petersburg, which was sent to Peter the Great by the Shah of Persia, measuring 16 feet 6 inches in height. Major Denham met with some in Africa which he judged to be 16 feet high, but one that he saw killed and measured was but 12 feet 6 inches, though he seemed to the major "an immense fellow." The greatest height ever measured by Mr. Corse was 10 feet 6 inches. The height of Chuny, the famous elephant destroyed at Exeter Change in 1824, is not given with the other measurements, but these are stupendous. The height of the body *as it lay* was 6 feet 3 inches, the girth of it 19 feet 4 inches, and the length of the spine 10 feet. The heart was nearly 2 feet long and 18 inches broad, and was found immersed in five or six gallons of blood. The length of the forehead, taken in a straight line, was 4 feet 6 inches. The food daily consumed by Chuny consisted of two trusses of hay, ten or twelve bunches of carrots, or an equal quantity of tares, a truss of straw (given as a bed, but generally eaten), and from thirty to thirty-five gallons of water.

THE DISTANCE OF A STAR FROM THE EARTH.

FOR many ages this question puzzled astronomers: How far off are the stars? It was known that their distance was great, very great. It was known that they were immeasurably farther off than the sun, the moon, or any of the planets; but it is only in the present century that the question has been even partially answered.

Of the countless thousands of stars which stud the universe, the distance of perhaps about twenty has been determined. Others which have been tried have defied the powers of the most skilful astronomers, aided by the most elaborate instruments; their distances are too great to allow of measurement, while the rest of the vast host which stud our firmament have not yet been examined with this object.

The inquiry is one of the most delicate and

subtle which can engage the attention of an astronomer. It is impossible to explain here the manner in which it is conducted; we must endeavour rather to realise the result which has rewarded these successful labours. There is a beautiful star in the southern hemisphere, the brightest in the constellation Centaur, one of the most brilliant stars in the heavens. This was diligently observed by the skilful astronomer who managed the observatory at the Cape of Good Hope in the years 1832 and 1833. He found, as the result of his labours, that the distance of this star—Alpha Centauri, as it is called—is twenty billions of miles.

It requires a little consideration to estimate what the words twenty billions of miles really mean. A billion contains one million millions, and we shall endeavour to convey an idea of this amount by a few simple illustrations. Supposing our great forefather Adam had commenced to count as quickly as he could, and that when his life was ended his son commenced to count, taking up from the number at which Adam left off, and spent his whole life, day and night, counting as fast as he could, and supposing that at his death he enjoined on his heirs an eternity of counting, and that they had continued doing so up to the present moment, their united efforts would not yet have reached the amount of one quarter of a billion; and yet the distance of the star is twenty billions of miles!

Another illustration may be given to convey an idea of this vast distance. If we were to take a sum equal to five times our national debt, and were to expend this in postage-stamps, we should get one billion of them; and if we were to draw a line round London, including every house in the suburbs, and then take an area equal in size to this cleared and arranged for the purpose; if we then commenced to stick them side by side over the entire area of London, we should not be able to get them all in. After we had covered every inch of the surface over completely, there would be countless thousands still remaining.

Such, then, is the distance of the nearest fixed star. We cannot grasp it in our imagination, nor are we more successful if we try to make a map. Suppose we proceed by first laying down the sun, and then placing the earth one inch distant from it. If we inquire at what distance the nearest star should be placed, using the same scale, we find it to be eleven miles. A map is therefore impossible.

Knowing, however, the distance of the nearest star, what can we say of the distance of the farthest of those that are visible? Here precise knowledge fails us. We can, indeed, grope after the truth, and make guesses of greater or less probability. We believe that it is, at all events, some hundreds of times as great as the astounding magnitude of which we have endeavoured to convey an impression.

PILGRIMS BATHING IN THE RIVER JORDAN.

MR. LYNCH gives us the following account of the spectacle annually witnessed, when the pilgrims flock to bathe in that part of the river which tradition declares to have been the immediate scene of the labours of St. John the Baptist:—"In all the wild haste of a disorderly rout, Copts and Russians, Poles, Armenians, Greeks, and Syrians, from all parts of Asia, from Europe, from Africa, and from far-distant America—on they came, men, women, and children, of every age and hue, and in every variety of costume, talking, screaming, and shouting in almost every known language under the sun. Mounted as variously as those who had preceded them, many of the women and children were suspended in baskets, or confined in cages; and, with their eyes strained towards the river, heedless of all intervening obstacles, they hurried eagerly forward, dismounted in haste, and, disrobing with precipitation, rushed down the bank and threw themselves into the stream. They seemed to be absorbed in one impulsive feeling, and perfectly regardless of the observations of others. Each one plunged himself, or was dipped by another, three times below the surface, in honour of the Trinity, and then filled a bottle or some other utensil from the river. The bathing-dress of many of the pilgrims was a white gown with a black cross upon it. Most of them, when they were dressed, cut branches of the *Agnus castus*, or willow, and, dipping them in the consecrated stream, bore them away as memorials of their visit. In an hour they began to disappear, and in less than three hours the trodden surface of the lately crowded bank reflected no shadow."

WONDERS OF WOOD CARVING BY THE NEW ZEALANDERS.

AMONGST works of art wrought by savages, the extraordinary and elaborate carvings in wood executed by the New Zealanders previously to their contact with Europeans, are well worthy of notice, and may be regarded as wonderful examples of ingenuity and skill, especially when we consider the rude nature of the tools by which they were wrought.

Ignorant of the use of iron, the New Zealand artist produced his carvings out of hard red pine, by the aid of an adze and chisel, formed of greenstone or jade, fastened into a wooden handle; whilst the edge of a sharp mussel-shell was employed to give the finishing touches to the more intricate portions of the design.

The men most skilled in wood carving were frequently "tohungas," or heathen priests, and were always regarded amongst the people with veneration and respect. Some tribes were more celebrated than others for the beauty and skill of

their carvings, many of which took years of patient labour to accomplish.

Perhaps the greatest amount of ornamentation was bestowed on the wooden monuments erected in honour of warriors of note, or chiefs of high rank and distinction. Domestic affection would also suggest a richly carved tomb to be raised to the memory of a deceased wife or child. These tombs vary in form and size, but usually consist of a box for the reception of the body, about ten or twelve feet high, covered by a projecting and slanting roof supported by pillars. These pillars represent human figures, one above the other, of grotesque forms, with enormous protruding tongues, and eyes inlaid with pearl shell. The entire front of the tomb is covered with similar faces in bas-relief, the space between them displaying the most elaborate arabesques intertwining with each other, mingled with double spiral curves, which have a very rich effect. Each of the human figures in its turn is similarly covered with the arabesque and spiral patterns; so that the tomb, viewed as a whole, presents one mass of intricate carving.

The flat gable-boards of the verandahs of their houses, and their "patukas," or raised storehouses for food, were carved in a precisely similar way, the double spiral pattern, with the grotesque faces, forming the same characteristic feature in all. Life-size grotesque figures, finely carved all over, frequently supported the roofs, whilst the door and window-frames were still more elaborately adorned.

CARVED MONUMENT IN NEW ZEALAND.

The heads and stern-posts of their war-canoes vied, in the richness of their design and the grace of their spiral curves and flowing arabesques, with the ornamentation of their tombs and houses; whilst their boxes for holding decorative feathers are wonders of New Zealand art.

Huge wooden images, precisely similar in pattern to the figures on the houses and tombs, were erected about their "pahs," or fortified towns, either to commemorate a victory or to honour some warrior chief; and in all these images the protruding, defiant tongue is a constant feature.

So great is the love of the New Zealander for wood carving, that he does not content himself with covering his houses, tombs, and canoes with the most intricate designs, but in like manner he decorates his weapons of war, his axe-handles, and his walking sticks; and, not content with wood for his material, he further displays his skill in tattooing minute spiral lines with tiny chisels on the faces of his chiefs, and on the lips and ankles of his women.

Since the colonisation of New Zealand by Great Britain, the natives have gradually abandoned their ancient art; and at the present time scarcely an example remains of these wonderful carvings, excepting such smaller objects as are preserved in the museums of the curious. In the mild and humid climate of New Zealand, the wooden structure soon rots away; and, ere long, not a tomb or a carved house will exist amidst the ruin of their deserted "pahs" to bear evidence of an art now passed away.

LATENT HEAT.

It is a wonder which must have struck the observant reader, that the water in a kettle never becomes hotter than that temperature at which it *boils.* If we place on the fire a kettle of cold water, we know that heat passes from the fire into the water, and it gradually becomes warmer and warmer until at last it tosses and bubbles, and we say it *boils.* If we had placed a thermometer in the liquid, we should have found that this temperature was 212° Fahrenheit; but when once the thermometer gains this height there it stays, although the heat is still passing from the fire into the water. What becomes of this heat? Where is it? Where has it gone to? It evidently has had no effect upon the thermometer, and therefore, since it exists somewhere, it is called *latent* heat, or *heat which has hid itself.* The truth has been discovered; it is this: that all bodies seem capable of existing in three states—solid, liquid, gaseous—and the power which causes them to change their state is heat. Before the water could become steam—that is, before it could exist in the gaseous state—it required a large quantity of heat; and this heat was so occupied with its own particular work that none of it came out to affect the thermometer, and therefore it does not in the ordinary way make known its presence.

The quantity of heat which thus is latent in steam is enormous. Of course we cannot measure heat by yards or pints; but the *unit of heat*, or the *measure of heat*, has been agreed upon to be *that quantity which can raise a pound of water one degree.* Now to turn a pound of water into a pound of steam, it requires 967 of these units of heat; that is to say, if we boil a pound of water until it all goes away into steam, we shall have used in doing so a quantity of heat which would have raised 967 pounds of water one degree higher in temperature.

Of course, when steam condenses, it gives off all this heat again. This fact is of the utmost importance in the economy of nature. Water gives off steam at all temperatures; ice and snow even evaporate, and thus give off steam. In this way there is a constant absorption of heat. If it were not for this, the heat of the sun would make the waters of tropical countries so warm that it would be fatal to the animals which live in them, and the inhabitants would have no means of cooling themselves in the intolerable heat. When the rays of the sun fall upon a surface of water, they cause rapid evaporation, and the steam thus produced absorbs the heat, which would otherwise have entered into the water. Then again, when that vapour condenses, it gives off its latent heat; so that the cold blades of grass, &c., at night receive warmth when the dew settles upon them, and this tends greatly to their rapid growth—so wonderfully is the temperature balanced.

The knowledge of the above facts enables us to explain many homely truths. Why is it that our hand feels cold when we blow upon it?—blow upon it too with warm breath! The reason is this: the skin is that organ which equalises the temperature of the body. This it does by allowing more or less perspiration to come to the surface and be evaporated, as the occasion requires. For example, when we run we cause greater activity in all the functions of the body. The blood passes through the heart more quickly; the action of the lungs is correspondingly increased; we breathe more rapidly: but this causes a greater generation of heat; the skin becomes aware that the body is getting too hot, so it opens its pores, and allows an extra quantity of perspiration to come to the surface. This evaporates, but requires for the change of state a large quantity of heat, which it takes from the body, and so the temperature is kept down. Wonderful provision! The steam when formed floats in the air; but the air can only contain a certain quantity, and when it has its complement it is said to be *saturated*, and can take up no more; so that when such an atmosphere rests on a moist surface, no evaporation can go on at all. The hand is always enveloped with a layer of air very full of moisture, and consequently little evaporation goes on; but when we blow upon the hand, we drive away this moist air, and it is replaced by dry air, and the evaporation proceeds rapidly, taking its necessary heat from the hand, thus causing the sensation of cold.

Some liquids, such as ether, alcohol, bisulphate of carbon, &c., evaporate more rapidly than water; and by causing ether to evaporate very quickly in a chamber of metal from which the air is exhausted, great cold is produced; for evaporation goes on very rapidly in a vacuum, as might have been expected.

We said that to transform a solid into a liquid, there was also a disappearance of heat. In melting a pound of ice, 142 *units of heat* are consumed, and the resulting water is of the same temperature as the ice before it melted; and what may seem more wonderful is, that if a piece of ice be placed in a vessel on the fire, a thermometer will indicate the temperature of 32°, Fahrenheit—the freezing point—so long as there is a particle of ice not melted; and only when the last piece has disappeared will the water begin to warm.

The quantity of heat required to melt ice may be comprehended from a calculation by Faraday, who found that to melt a cubic yard of ice, the heat given out by the burning of a bushel of coals would be required; and Pouillet, the French Faraday, said that if the globe were covered with a layer of ice 104 feet thick, it would require the heat of the sun's rays for a whole year to melt it!

HUMAN AND ANIMAL BONES.

It is remarkable how frequently the bones of horses, cows, dogs, and sheep are mistaken for those of human beings. "In an antiquarian collection of relics obtained from a neighbouring Roman castrum, I saw (says Dr. Alfred Taylor) the tibia of a dog carefully labelled and religiously preserved as the bone of an ancient Roman. The same collection contained fragments of bones of various animals—carnivorous and herbivorous—all marked as human relics. This collection belonged to an antiquary who preferred adopting his own view of the nature of the relics to taking the opinion of any one acquainted with anatomy. Even well-informed men may be easily mistaken on such subjects. Belzoni, the celebrated traveller, brought from Egypt, with his sarcophagi, a number of bones taken from the interior of the Pyramids, which he pronounced to be the bones of King Cephrenes, and of some of the Shepherd kings. The late Mr. Clift, of the Royal College of Surgeons, by the request of a friend, went down to examine them after they had been submitted to public exhibition, and he found that they were nothing more than the bones of oxen. The osseous relics of saints, as they are collected and preserved in glass and crystal cases in Roman Catholic countries, often present anomalies which would surprise an anatomist. Supernumerary ribs and vertebræ are not uncommon, and intermixed with them I have seen bones which certainly never appertained to a human being.

"These facts show the importance of entrusting the examination of bones, in all judicial inquiries, to well-educated medical men. The lamentable effects of popular ignorance were displayed in a case that occurred at Damascus in 1840, which at the time excited great public notice. A Roman Catholic priest and a boy suddenly disappeared in the early part of that year, and a strong suspicion arose that they had been murdered. Certain Jews were charged with having murdered them. The sewer in the quarter of the town in which they lived was examined; and some bones were there found. These were pronounced by the persons who discovered them to be human bones, and the discovery was considered sufficient to confirm the suspicion of murder which had arisen. Several of the accused Jews died under the tortures to which they were subjected. Some persons who inspected the bones pronounced that they must have been lying in the sewer for a great length of time, and that they were those of an animal. A proposition was then made that the bones should be packed in a box and forwarded to the Parisian Academy of Medicine for their decision. I believe it was subsequently clearly proved that they were animal remains."

SPONGE.

Among the wonders of the sea there is none more remarkable than the common sponge. For a long while it was disputed whether the creature belonged to the animal or vegetable world, and until quite lately the opinion prevailed that it was a subject of the vegetable kingdom. Modern science has ascertained that sponge is beyond all question an animal production—not the work of any highly organised animal, but still of creatures distinctly animal. Sponge, as we commonly see it, is an intricate network of filaments of a horny substance, and solid, having here and there in their midst caverns or cells, into which the passages that honeycomb the sponge converge. Imbedded in these filaments are numerous tiny, needle-shaped pieces of calcareous matter, with a knob at one end and a point at the other. These calcareous pins are, in reality, closed tubes; for, according to Dr. Grant, a principal authority upon sponges, "when the spicula are examined through a microscope after exposure to heat, we distinctly perceive a shut cavity within them, extending from the one point to the other; and on the inflated side of each spiculum we observe a ragged opening, as if a portion had been driven out by the expansion of some contained fluid. In those spicula, which had suffered little change of form by their incandescence, I have never failed to observe the same cavity within, extending from one end to the other, and a distinct open rent on their side, by which the contained matter has escaped before the usual globular distension had taken place."

The filaments and spicula together make up an abode in which dwell, not crabs or fish, or anything of their respective kinds, but an infinity of small gelatinous cells, each one possessing a perfectly independent existence, and able, when detached from its fellows, to move onwards by the extension of its substance. Examine a living sponge in its home in the water, and a rapid stream of water will be seen issuing from the large orifices of the structure, bearing with it a number of minute particles from the interior of the sponge. Water has been absorbed through all the small openings with which the surface of the sponge is studded, and after having traversed the many passages into which those openings lead, is thrown out into the canals, and by them conveyed through the greater adits to the open water. The function of this stream and of this circulatory system is manifold; it conveys nutriment to the cells, which are the sponge-creatures, and also serves for the purpose of respiration, besides assisting materially in the propagation of the sponge.

There are many different sorts of sponge; some of them inhabit our own coasts, some live in fresh water, but the finest specimens of the best kinds of

sponge are to be found in tropical waters, in the Mediterranean, in the Grecian Archipelago, in the East and West Indies. The most valued sorts are found at some depth below the water, and must be dived for, as they never allow themselves voluntarily to appear above the surface. They anchor themselves to any good holding-ground that comes in their way—a branch of coral, a jutting piece of rock, anything that happens to be convenient. Dr. Johnston, in his "History of British Sponges," mentions an instance of a large British sponge being found attached to the back of a living crab. Sponges resemble coral in this, that when exposed to the action of a rough sea they become larger and thicker, and grow more rapidly than when in situations where the conditions are gentler—a fact which is perhaps due to the frequently-changing medium which brings at every turn and roll a fresh supply of food for the gelatinous aggregation of cells which is the true sponge, and a fresh supply of material to strengthen the horny fibres and siliceous or calcareous spicula which are the skeleton and framework of the sponge animal.

Some sponges have a generic shape, as a cup, globe, or tree; while others grow, as it were, anyhow, covering the rock, shell, or whatever else it may be to which they are attached with a formless cover of soft spongy material. If two sponges of different kinds meet in their wide home in the depths of the sea, it is not found that they ever unite, nor do they ever cross the breed. A mechanical union there may be, nay, there often is; but so far from any disposition to unite having been seen, experience declares that disunion is the invariable rule. No matter how much the sponges may be interlaced and intertwined, they remain ever distinct and distinguishable.

SPONGE.

Certain sponges have the faculty of boring into substances of which the hardness would seem to defy any but the best mechanical contrivances. Shells, coral, rock, are pierced with surprising facility. The sponges bore their way into the rocky substance, maintaining their communication with the water, and by continuous attacks disintegrate the mass, so furnishing rubble and small stones for the building which *corallia* and the other handicraftsmen of the ocean are perpetually rearing to the glory of their Maker.

Concerning the method in which sponges are propagated, there have been many opinions. Some sponges undoubtedly are propagated by eggs, others by buds, which detach themselves at maturity, and are the embryo and nucleus of new sponges. In most of the sea-sponges, minute buds are formed in the gelatinous coating of the sponge-comb, as it may be called; these are borne out by the current which rushes through the larger openings on the surface of the sponge, and are borne hither and thither for a time till an object is found to which they can attach themselves. The object once found, the germ is faithful for ever to it, and remains embracing it during the whole period of its existence. In fresh-water sponges a different system is observed. Seed-like substances are formed in the body of the sponge, consisting of several cells united in a globular mass. After a while this mass becomes enveloped in a capsule, on the outer surface of which a radiated series of spicula is developed. As the body matures, the contents increase in size, till the confederated cells, becoming ripe and of equal dimensions, burst their cover and are diffused through the water. In a few days they re-unite in groups resembling in appearance the gelatinous substance of the mature sponge; but in their transition state they undergo many changes of form, and are of insatiable appetite. Mr. H. J. Carter, of Bombay, says in one case he saw "one of these creatures approach a gelatinous body, something like a sluggish or dead one of its own kind, and equal to itself in size, and having lengthened itself out, so as to encircle it, send processes over and under it from both sides, which, uniting with each other, at last ended in a complete approximation of the two opposite folds of the cell wall throughout their whole extent, and in the complete enclosure of the object. Even while the protean was thus spreading out its substance into a mere film, to surround so large an object, a tubular prolongation was sent out by it in another direction, to seize and enclose in the same way a large germ which was lying near it. It took about three quarters of an hour to perform this."

VOLCANIC ERUPTIONS.

THE great volcano named Vesuvius, which is now so constantly in eruption, was described by the ancients as a cone-shaped mountain with a flat top, on which was a deep circular valley filled with vines and grass, and surrounded by high precipices. A large population lived on the sides of the mountain, which was covered with beautiful woods, and there were fine flourishing cities at its foot. So little was the terrible nature of the valley on the top understood, that in A.D. 72, Spartacus, a Roman rebel, encamped there with some thousands of fighting men, and the Roman soldiers were let down the precipices in order to surprise and capture them. There had been earthquakes around the mountain, and one of the cities had been nearly destroyed; but no one was prepared for what occurred seven years after the defeat of Spartacus. Suddenly a terrific rush of smoke, steam, and fire belched from the mountain's summit; one side of this treacherous valley was blown off, and its rocks, with vast quantities of ashes, burning stones, and sand, were ejected far into the sky. They then spread out like a vast pall, and fell far and wide. For eight days and nights this went on, and the enormous quantity of steam sent up, together with the deluge of rain that fell, produced torrents on the mountain-side, which, carrying onwards the fallen ashes, overwhelmed everything in their way. Sulphureous vapours filled the air, and violent tremblings of the earth were constant. A city six miles off was speedily rendered uninhabitable, and was destroyed by the falling stones; but two others—Herculaneum and Pompeii—which already had suffered from the down-pour of ashes, were gradually filled up with a flood of water, sand, and ashes, which came down the side of the volcano, and finally were covered up entirely. In succeeding eruptions much lava was poured out; and in A.D. 472, ashes were cast forth over a great part of Europe, so that much fear was caused at Constantinople. The cities were more and more covered up, and were only discovered in A.D. 1713, when, in digging a well, a theatre with some statues was *disclosed*. Since then numerous curiosities have been dug up, wonderfully preserved by the ashes.

ERUPTION OF VESUVIUS.

The eruptions of the volcanoes in Iceland have been amongst the most terrible of those carefully recorded. The cold climate of the island and the height of the mountains produce vast quantities of snow and ice, which cover the volcanoes and fill up the cracks and valleys in their sides. When, therefore, the eruption commences, the intense heat of the boiling lava, and of the steam which rushes forth from the crater, makes the whole mountain hot, and vast masses of ice, great fields of snow, and deluges of water roll down the hill-side into

believe that there are men whose feet stand opposite to ours, and who are able to walk with their legs upwards and their heads hanging down; that there is a part of the world where all things are topsy-turvy—where the trees grow with their branches downwards, and where hail, snow, and rain fall upwards?' 'Did not St. Augustine say that the doctrine of the antipodes was altogether irreconcilable with the historical foundation of the Christian faith? for whoever said that there were inhabited countries on the opposite side of the earth asserted that there existed in those countries men who were not derived from Adam, since it was impossible for his progeny to pass the intervening ocean. Such an opinion must destroy our belief in the Bible.'

"Thus spoke the opponents of the great man. Two years later Columbus returned from the West Indies. The earth was small and spherical, and there were inhabited countries at the other side of it. But not only the earth, the heavens also contradicted the doctrines of the great luminaries of the church. For, in consequence of the discoveries of Copernicus, the earth had ceased to be considered the centre of the universe. It was not only small, narrow, and spherical—it was a mere point in endless space—a small planet revolving round the sun."

WHITE CHALK.

CHALK is such a common thing that it is difficult to think there can be anything wonderful about it; but when carefully studied and examined, few substances turn out to be more extraordinary. Chalk is wonderful on account of its forming a large part of the crust of the earth, and because it consists of countless fragments of minute creatures which were once alive; moreover, the manner in which the bold white cliffs stand up against the sea, century after century, is worth considering, as is also the way in which the long layers of flints, one over the other, were formed. Chalk is a very old substance, for the cliffs have stood by the sea-shore longer than the oldest history tells of; and when inland, the white chalk is often found in sinking deep wells through clay and sand. Geologists have proved that although most of the chalk now forms dry land, high hills, and bold cliffs, yet it was produced layer after layer at the bottom of a very deep sea, and was gradually lifted up by the internal forces of the globe to its present position. It is found in a great many of the counties of England quite on the surface of the ground, and in others it is situated deep down in the earth, being covered up with other soils. Vast regions in North and South America, Ireland, Denmark, Belgium, Germany, France, Algiers, and India are covered with the powdery-looking mineral we call white chalk, and much of it is under the sea, and is occasionally found out in sinking foundations for lighthouses. Not only does the chalk form the surface of the ground over a large portion of the earth, but it is also very deep. A cliff, although 500 or 600 feet high, does not show all the chalk, for boring proves that it goes down deeper than the level surface at its foot. In England, especially in the south-eastern counties, the chalk is very deep, and extends downwards for 1,200 feet. The upper part, as is well known, has many layers of black flints in it, one over the other, and extending for miles; the lower 700 feet of chalk has no flints in it, but forms in many foreign countries high mountains with tall peaks and precipices, very unlike the rounded downs and sloping valleys in England. It was mentioned that some soils were on top of the chalk in certain places. Now, there is a capital example of this in London. There is chalk on the Surrey side of the Thames, but it does not appear on the north side. When a well is dug on the south side, chalk is soon come to; but in London itself a dark blue clay is found, and it is no less than 800 feet deep. The clay must be pierced by the boring-machine for rather more than this depth before chalk is reached. Of course, all this great mass of clay, double the height of St. Paul's, was collected gradually on the top of the chalk, and it was not done in a day. Many thousands of years must have elapsed whilst it was being made, for it was the washings of distant hills brought down by many streams, like the clays which are now forming at the bottom of lakes. There are all sorts of wonderful things in this clay, such as skeletons of great crocodiles, alligators, beavers, fish, birds, and turtles, masses of decayed fruits like cocoa-nuts and pineapples, and vast quantities of small shells. But the chalk is under all these, and is therefore older. If a small piece of chalk is moistened and rubbed on a slip of glass, and placed under a powerful microscope, myriads of very small things are seen. Some are fragments of larger things, but the greater part consists of the tiny skeletons and shells of what are called animalcules. Much of the chalk consists, also, of round grains, which, when broken down, are found to contain other grains arranged in circles round a centre. These are all remnants of very small creatures, which were once alive. So small were they, that 10,000 of them placed in a row would not make up an inch in length. The shapes of the little shells are very pretty, and they are beautifully marked with dots and lines, so as to form very interesting objects under a good microscope. Every piece of chalk contains a vast quantity of these things, and also grains of what is called carbonate of lime.

By diligent search amongst the chalk quarries many curiosities have been found, and the skeletons of flying reptiles, huge lizards, crocodiles, and beau-

tiful shells, and great quantities of sea-urchins and star-fish, may be seen in the British Museum taken from the chalk. Some of these are very large, but the bulk of the chalk all over the world is made up of very minute things invisible to the naked eye. If the chalk extends for thousands of square miles, and is 1,200 feet thick, what incalculable millions of the remains of minute creatures there must be in it! The tiny animalcules lived in the old ocean, and as they died their hard shells fell to the bottom, and in course of ages the mass of the chalk was thus formed as a sediment in the deep sea. It is impossible to conceive how long this sediment took to collect, but it is easy to form an idea how long a small portion of chalk takes to be removed. Thus, the island of Thanet is about ten miles long and five broad, and the chalk is, in round numbers, 1,200 feet thick: there are, therefore, about 42,000,000,000 tons weight of it. Supposing 1,000 men and 1,000 horses and carts to do always what is called a good day's work, it would take them 20,000 years to remove the chalk, provided it were dug up ready for carting. The history of chalk is, therefore, very wonderful, for it was gradually deposited in the deep ocean, being formed of the remains of the smallest sea animalcules and of the skeletons of the large creatures that died in the water. After 1,200 or more feet of this fine white sediment were formed, the whole was lifted up nearly to the surface, and then a clay was formed on the top in many places. The creatures whose remains are found in the clay are not of the same kind as those found in the chalk, and were in existence when this country was in a tropical climate.

REMARKABLE SLEEPERS.

THE actual amount of sleep necessary to certain individuals depends in a great measure upon their bodily disposition, or upon habits acquired by necessity or choice. Soldiers during a siege, or sailors on board ship, soon form a habit of falling asleep in any easy position the moment the eyes are closed. King George's statement that only a fool required so much as eight hours' sleep is not quite true, for many clever men have been remarkable sleepers. It may be sufficient for the present purpose to mention that Dr. Reid, the celebrated metaphysician, has been known to consume as much food, and afterwards to take as much sleep, as would have sufficed for two days. And there are numerous cases on record in which sleep has been prolonged for weeks or even months.

Blanchet, a French physician, in the "Comptes Rendus," 1864, records three cases of what he terms "constitutional lethargic slumber." In one of these cases the patient, a lady aged twenty-four years, slept for forty days when she was eighteen, and for fifty days when she was twenty; and the last recorded sleep was for nearly a year—from April 20th, 1862, to March, 1863. She was supplied with liquid nourishment during this period by having a false front tooth removed. She was motionless and insensible; the pulse was low, and her breathing scarcely perceptible; she showed no signs of leanness, and her complexion continued florid and healthy. The following letter, copied from a rare book in the possession of the writer of the present article, entitled "British Curiosities in Nature and Art," &c., published in London in 1713, gives an account somewhat similar to those quoted above, of a remarkable sleeper whose name is not mentioned in the letter, but it is similar to the case of Samuel Clinton, recorded in the "Philosophical Transactions," and quoted on page 122 of the present work. The letter is introduced by the following remarks from the author of the "British Curiosities:"—

"Not far from Wells, some years agoe, was a wonderful instance of *a Man's sleeping;* it was sent in a Letter from a Clergyman to my Worthy and Ingenious Friend, *Charles Bowles*, late of *Windsor*, Esquire; who was so kind to oblige me with it. I think the Man slept at least a Month or 6 Weeks longer than the time mentioned in the Margin of the Letter. Which take as follows.

"'SIR, "'Tiverton Octob. 19.

"'The last visit I made to see this unaccountable Sleeper, was on Wednesday last, the 13th of this Instant, where I found him in the same Posture, as he hath continued in ever since his first Seisure;* for he lies confin'd to his bed; eats his Victuals once or twice a Day, but never in the Sight of any one; and looks as fresh as if he went daily to his Labour. The Observation of him, that is fresh, is this; that on Sunday the 10th of this Month, his Brothers wishing to try an Experiment, put on all his Clothes, brought him down Stairs from his Bed, and set him in a Chair by the Kitchin Fire; but this, they thought would have cost him his Life; for they visibly perceived a great alteration in his Countenance, which as he lay in his bed, was fresh and lively, was converted into a dark Paleness, like Death; his head hang'd on his Shoulder, as though he had been really Departing, which obliged them to put him away to his old Apartment, where in a little time he recovered his former Sanguine Complection; He is removed from his Brothers to his Mothers-House again. This is the only and best account I can a present give you; if there be any other change you shall be sure of it;

"'From Your most Humble Servant,

"'JOHN RICH.'"

Learned John Stow, the London antiquary, records the following:—"April 27th, 1546, was Tuesday in Easter week, William Foxley, pot maker for the Mint in the Tower of London, fell

* August the 12th to Octo. 14th is 10 Weeks.

THE FRIGATE-BIRD.

asleep, and he continued sleeping, and could not be wakened with pinching, cramping, or otherwise burning whatsoever, till the first day of term, which was fourteen days, and fifteen nights. The cause of his thus sleeping could not be known, although the same were diligently searched after by the king's physicians and other learned men: yea, and the king himself examined the said William Foxley, who was in all points found at his waking to be as if he had slept but one night; and he lived for more than forty years after in the Tower."

Wonderful Birds.

THE FRIGATE-BIRD.

ONE of the greatest wonders in natural history is the flight of birds. We have been all our lives so accustomed to see birds, that we are not now prone to marvel at the wonders of their flight. We must meditate on the beautiful arrangements by which they are enabled to raise themselves in the air and propel themselves through it, and we must remember how utterly futile all man's attempts to fly or make flying-machines have proved, and then we are in a condition to appreciate the marvel which is daily before our eyes.

The frigate-bird, which is represented in the engraving, is endowed with magnificent powers of flight. His wings stretch to an expanse of about ten or twelve feet; his body is about three feet long; his bill is very powerful, and adapted for seizing. His feet are webbed, but very small; he has but little use for them, his home being in the air, hundreds of leagues away from land. He is seen soaring high above the ocean, but on its bosom he never rests. When he seeks repose he finds it aloft in the air. His foot rarely touches land except at the time for pairing, making nests, and rearing young. How is all this? The expanse of his wing is so vast, and his body is so light, that he can soar with little or no exertion. Still it is difficult to see how this would enable him actually to sleep on the wing, as it is believed he does. A more close examination shows, however, that his bones are hollow, and that there is a large pouch communicating with his lungs and with the cavities in the bones. This pouch he can inflate with air, and thus render himself buoyant: the sustaining power thus acquired, added to that of the wings, is sufficient to keep him up.

If his home be in the air, if he neither dive into the sea for fish, nor search on the land for other food, whence does he derive his sustenance? Impelled by hunger, he descends from the lofty regions where it is his delight to dwell. Whether the

sea be rough or calm, he glides along over the water, and any unwary fish approaching the surface, on being detected by his keen eye, is pounced upon instantaneously and swallowed.

But the frigate-bird has other resources: though he cannot dive into the sea to catch fish, he avails himself of the labours of birds which can. He watches one of the birds which dive; he sees him emerge successfully, and fly off with his prey. Instantly the frigate-bird is down upon him with a swoop of terrific velocity. The frightened diver drops his fish in mid-air; the frigate-bird poises himself again, darts down with another swoop, and seizes the fish ere it reaches the water.

Wonders of Mechanical Ingenuity.

AUTOMATA.

AUTOMATA, or self-moving machines to imitate any actions of men or animals, are of very ancient date, and show that considerable success has attended this class of inventions; thus, Dædalus is stated by Plato and Aristotle to have made statues which could not only walk, but required to be tied up that they might not move. Aristotle speaks also of a wooden Venus which moved about in consequence of quicksilver being poured into its interior.

To come to more recent times, Bonnet, in his "History of Music," 1774, relates that a certain Alex, an ingenious Provençal mathematician and mechanician, having discovered the sympathy of sound in two instruments tuned in unison, to illustrate his discovery, constructed an automaton skeleton and placed in its hand a guitar, while by a mechanical contrivance the fingers moved as though playing it; he then set it at a window, and at a proper distance placed another guitar, which produced sound in the instrument held by the figure. The inhabitants of Aix (the town in which this was exhibited), believing that the skeleton really played on the guitar, denounced Alex as a sorcerer, and he was condemned by the Parliament to be burnt alive, together with his figure.

Camus, the mathematician, constructed for the amusement of Louis XIV. a small coach drawn by two horses. The coachman cracked his whip, and the horses set off, drawing the coach about on a table; and when opposite the king it stopped, the page got down and opened the door, on which a lady alighted, with a curtsey presented a petition to the king, and then re-entered the carriage. The page then shut the door, the carriage proceeded, and the servant running after it jumped up behind it. This is gravely related by Dr. Hutton in his "Mathematical Recreations." The automaton coach and horses was a common street exhibition in our day.

Maillardet, a noted mechanician, constructed an automaton boy, which both wrote and drew with a pencil, kneeling on one knee. When the figure began to work, an attendant dipped the pencil in ink, and adjusted the drawing-paper upon a brass tablet. Upon touching a spring, the figure proceeded to write, or to execute landscape drawings. Maillardet also constructed a magician, who answered questions inscribed in oval medallions upon a wall; one of which the spectator having selected, it was shut up in a spring drawer. The magician then rose, consulted his book, and striking the wall with his wand, two folding doors flew open, and displayed the answer to the question. The door again closed, and the drawer opened, to return the medallion. The machinery being wound up, the movements, in about an hour, answered fifty questions; and the means by which the medallions acted upon the machinery, so as to produce the proper answers to the questions, are stated to have been very simple. Maillardet also constructed other automata, including a spider made of steel, and a caterpillar, lizard, mouse, and serpent, all with their natural movements. His automatic figures, including a harpsichord player, a rope-dancer, and a singing bird, were exhibited in Spring Gardens, London.

M. Houdin, in 1844, exhibited an automaton writer, which attracted the notice of Louis Philippe and his family. The figure drew as well as wrote answers to questions, and, by a curious coincidence, its performance on one occasion was particularly ominous. When the Comte de Paris requested it to draw a crown, the automaton began drawing the outline demanded, but its pencil broke, and the crown could not be finished. Houdin was about to recommence the experiment when the king declined with thanks. "As you have learned to draw," he said to the Comte de Paris, "you can finish this for yourself." This incident is characteristic as regards the tact of the king.

Houdin had remarkable resources in his art. He once received a commission from a merchant at St. Petersburg to construct an automaton nightingale, and he agreed, for a large sum, to make a perfect imitation of the bird. He had already made several musical birds, but their singing was quite arbitrary. The imitation of the nightingale's pipe was much more delicate, for he had to copy notes and sounds which were almost inimitable. Houdin resolved to take the skilful songster as his teacher. For this purpose he went constantly to the wood of Romainville, which almost joined the street in which he lived, and here he repaired for lessons; for the nightingale sings both by night and by day, and the slightest whistle makes him strike up directly. Houdin had to analyse the bird's melodies by a musical process. To imitate its flexibility of throat, and reproduce the harmonious modulations, Houdin made a small quill-like copper tube, in which a steel piston, moving very freely,

produced the different sounds required; thus the tube represented, in some respects, the nightingale's throat. The instrument had to work mechanically; clockwork set in motion the bellows, opened or closed a valve which produced the twittering, the modulation, and the sliding notes, while it guided the piston according to the different degrees of speed and strength wanted. Houdin had also to impart motion to the bird. It must move its beak in accordance with the sounds it produced, flap its wings, and leap from branch to branch—which, however, was purely a mechanical labour. After repeated experiments, and practice in the wood, Houdin succeeded in creating a system, half musical and half mechanical, which only required to be improved by fresh studies from nature; and thus, by frequent rehearsals and comparisons, he persevered until the nightingale's song was perfectly imitated.

CURIOUS CUSTOMS.

THE GRACE CUP.—The origin of the grace cup, or, as it is sometimes called, the "loving cup," passed round from guest to guest at state banquets and city feasts, is thus accounted for by Miss Strickland, in her "Historic Sketches:"—"The grace cup derives its name and use from an amusing little fact illustrative of the manners and customs of the Scotch nobles in the eleventh century. That royal Christian civiliser, Margaret Atheling, the consort of Malcolm Kenmore, observing that they had an irreverent habit of rising and quitting the table before grace could be pronounced by her chaplain, promised to reward all who could be induced to tarry for that ceremony with a draught *ad libitum* from a large gold cup of the choicest wine, which was passed from hand to hand round the board, after the thanksgiving for the meal had been duly said. The bribe offered by the beautiful young queen was too agreeable to be resisted by the hitherto graceless northern magnates; each was eager to claim his share of the grace cup, as this social goblet was called; and the custom thus instituted in the palace became so popular, that it was observed in the barons' halls, and wherever festive cheer was to be found throughout the land. The fashion of the grace cup was of course adopted in England by all degrees who could afford to honour a custom so much in unison with national taste. Every person of consequence could boast of a grace cup in the Middle Ages, and even at the period of the Reformation they are occasionally enumerated and described in inventories of plate and jewels, and bequeathed in wills."

THE FREEDOM OF ALNWICK.—By an ancient charter of the town of Alnwick, in Northumberland, every freeman, on his initiation, is compelled to jump into a muddy pool, and scramble to the opposite bank. This custom was imposed by King John, who is said, when travelling once in the neighbourhood, to have stuck in a morass and been bemired. As a punishment to the townsfolk for not keeping their roads in better condition, he ordered that thenceforth this disagreeable rite should be observed by every new freeman of the town; and, as its charter has never been altered, the custom has continued down to the present day.

Wonderful Trees.

THE UPAS TREE.

FEW trees have had a more remarkable history than the famous poison tree of Java and the Indian Archipelago. For two centuries its strange story had been accumulating, each traveller who visited the islands where it grew adding some marvellous particulars to the narrative, and generally attesting his statements by the declaration that he saw the marvels he records. At last, in 1783, the record became complete in the account given by Foersch, a Dutch physician, which has been justly characterised as one of the most impudent fabrications that has ever been palmed on popular credulity. He described it as growing in a desert tract, all vegetation being destroyed for a distance of ten or twelve miles around it by its deadly exhalations. No quadrupeds, not even rats or mice, are seen in this region of desolation. When any birds fly within reach of the poisonous effluvia they instantly perish, and even the waters are destitute of fish. The imagination cannot conjure up a more desolate picture than this tyrant tree in the centre of its barren waste—every trace of life, both animal and vegetable, destroyed—nothing but the dark dry soil and the silent atmosphere, except in that small central spot where the verdant grove is ever distilling its poisonous vapours. The old priest from whom Foersch says he got his information, assured him that "there is a continual perspiration issuing from the tree, which is seen to rise and spread in the air, like the putrid steam of a marshy cavern." Criminals condemned to death were offered the chance of life if they would go to the upas tree and collect some of its poison. They were furnished with proper directions, and armed with due precaution, but not more than two out of twenty ever returned. One who had thus saved his life, Foersch says, told him that the ground around the tree was covered with the bones of those who had perished; and on one occasion civil war drove a population of some 1,600 to within twelve or fourteen miles of the tree, and within two months 1,300 of them perished. The poison was obtained from the tree by piercing it with a long bamboo rod furnished with a sharp point, so that the person using it should not come in contact with the juice, which would stiffen and contract his joints. The poison was of great value, as arrows dipped in it were so destructive in the

native wars. A slight wound, even in the heel, just sufficient to draw blood, not only produced death, but rendered the flesh within half an hour so putrid as to separate easily from the bones. This extraordinary piece of fiction, being published in a popular English journal, was speedily copied into other British and many foreign periodicals, and was generally believed. The introduction of the whole story into Darwin's "Loves of the Plants," embellished with all the artifices of a florid style of versification, confirmed this belief. Although warned of the falsehood of the statement, the poet was stronger in him than the philosopher; he could not consent to lose or mutilate so fine a digression.

Our illustration conveys to the eye what a tissue of error the whole narrative is, as has been clearly proved by Horsfield, Blume, and Bennett. The inquirer will find in the work of the last-mentioned author an interesting historical account of the growth of the fable, and an accurate description of the plant itself and its properties.

THE UPAS TREE OF JAVA.

As in most other travellers' tales, there is in this also a grain of truth, though nearly obscured by the mass of error. The tree produces a milky juice, from which one of the most virulent of vegetable poisons is prepared; but the growing tree is in itself not actively injurious. It gives off no subtle poison to taint the air around it. Vegetation flourishes at its base, and it may be approached or ascended by man like the other trees of the forest. Only when a tree is extensively wounded, or cut down, and a large quantity of the juice is exposed to the action of the atmosphere, are its injurious effects at all felt, and then it produces a slight heat or itching of the eyes. The inner bark—which is of a close fibrous texture, like a very coarse piece of linen—is, after being carefully bruised, steeped and washed, made into rude garments which the poorer labourers wear in the field. But they can never get the fibre completely rid of the juice that originally abounded in it; for if the wearer happens to get wet, an intolerable itching is produced by the covering, which makes it unbearable.

Horsfield, during his residence in Java, made numerous experiments with the poison on various quadrupeds. He found that a monkey died in seven minutes, a cat in fifteen, dogs at different intervals up to one hour, and so on.

The tree has a very noble aspect. It rises from sixty to eighty feet without a branch, then sends off a few stout horizontal branches, which sub-divide, and form a somewhat irregular crown. At the base, the trunk produces numerous broad wings, which gradually decrease upwards until they disappear. These processes greatly increase the circumference of the base of the stem, making a stem which is nine feet round where they disappear as much as thirty feet round at the base.

THE GREAT IRISH DEER.

In the caves, gravels, and peat-bogs of these islands we find not unfrequently the remains of animals which no longer inhabit Western Europe. Some of these animals still exist, as the aurochs, or European bison, in Russian Poland, the reindeer in Lapland, and the musk-ox, of which fossil remains occur in Devonshire, but which now is only found existing in extreme northern regions. Others, again, are entirely extinct, as the mammoth and the woolly rhinoceros, both of which were formerly extremely common, especially in England. To the last category belongs the animal (*Megaceros Hibernicus*) which is the subject of the present notice, and it has generally received the name of the *Irish* elk, owing to the great abundance of specimens found in Ireland. The megaceros has, however, also been discovered in parts of Western Europe. The creature has generally been called an elk, probably because the largest member of the deer family still existing bears that name, but it does not resemble the elk in any way. The true elk is a clumsy-looking beast, with broad antlers furnished with few tines. The megaceros was intermediate in character between the reindeer and the fallow-deer, but was much larger than either. Its antlers were magnificent, measuring as much as ten feet across from tip to tip, and weighing, with the skull, as much as a hundred pounds in some instances. The antlers have broad palms, and are furnished with a large number of tines. When, however, the palm is well developed, the tines are smaller and the spread of the horns less considerable. The name megaceros, *big-horn*, is well suited to a creature whose head must have formed such a noble object. The height of the animal was about six feet at the shoulders, while the hind-quarters drooped only very little, so that it was somewhat taller than a horse. The most remarkable feature about the skeleton is the development of long processes on the dorsal vertebræ, which were undoubtedly intended as points of attachment for the muscles required to move the heavy head. The female had no horns, as is almost always the case in the deer family. This deer inhabited the outskirts of the forests, and its remains are found almost without exception in the marl at the outside of peat-bogs. In such abundance do they occur, that in one small bog near Lough Gur, in the county of Limerick, upwards of seventy heads were dug up in the autumn of 1864, in addition to a very

SKELETON AND OUTLINE OF THE GREAT IRISH DEER.

large number which had been obtained in previous years.

The point about which there has been most discussion regarding the megaceros, is as to whether it was contemporaneous with man or not; and on this it is not easy to arrive at a satisfactory conclusion from the evidence obtainable here.

The instances which have been adduced of the discovery of the bones associated with implements of human manufacture have all been explicable on the supposition that they were accidentally thrown together in a bog-hole. Traditionary evidence of the existence of the megaceros is very vague. The most positive statement is that, in an old History of Ireland, published by Pepper about the middle of the seventeenth century, it is stated that the ancient Irish lived on the flesh of a large black deer. The same statement is said to have been found on some brass tablets which came under the notice of the late Sir William Betham. However, the tablets are not now forthcoming, and the history is a very scarce book, having been suppressed by the English Government, owing to its treasonable nature, after the rebellion of 1641. Accordingly, neither of the statements can be considered as traceable to thoroughly authentic sources.

In old Irish manuscripts there are frequent allusions to field sports; and in one of them particularly, called the "Book of Lismore," the descriptions of deer and deer-hunts are not uncommon. Most of these would suit red-deer as well as the animal which we are now discussing; however, one of them seems to refer to a deer with very large antlers, and to show that it was existing in the time of St. Patrick. The Irish name for the great deer was the "Ox of the Deluge." The passage in question was discovered by the late Professor O'Curry, and was read before the Geological Society of Dublin some years ago.

Although Pausanias was certainly wrong in his idea of the structure of the elephant, we see that he certainly knew of a large deer, and, as he describes it as inhabiting the country of the Celts, it may possibly have been the megaceros, as the elk is found in Eastern Europe, and is not peculiar to France and these islands.

As regards the occurrence of this giant deer on the continent, the evidence is pretty conclusive as to its existence simultaneously with man in Switzerland; but then we must remember that that country was inhabited by men long before they found their way to these islands. The traditionary evidence is, however, uncertain. In the famous mythical ballad of Germany called the "Nibelungen Lied," it is said of one Sifrid—

> "Then he slew outright a buffalo and an elk,
> Four powerful aurochses, and one fierce *schelch*."

Three of these animals are well known; but as to the fourth, there is nothing to show what it was, and the only character attributed to it is fierceness. However, it has been assumed to be the megaceros, simply because that was an animal which might probably be classed among game.

For a reason somewhat similar to the foregoing, it has been asserted that at the time of the Roman invasion of England the giant deer existed here. The statement is, that at that period the forests lying round Manchester were inhabited by a large animal called a "segh," which was subsequently exterminated.

The foregoing statements can scarcely be said to lead us to a definite conclusion, but still there seems a fair *primâ facie* probability that under all this smoke there was some fire, and that an animal different from any deer now existing was meant.

The remains themselves are in a very good state of preservation in many instances. The bones and antlers, though almost of the consistence of leather when first exhumed, soon dry and become as hard, or harder, than fresh bones. The organic matter in them is scarcely changed, for they will burn freely when thrown on the fire, and when holes are drilled in them in order to insert the iron supports for setting up a skeleton, a very strong and unpleasant odour is emitted. There is a story current that a leg-bone was once discovered with remains of hair upon it; but, though diligent search has been made with the view of testing such an interesting fact, it has failed to elicit anything as to where the specimen now is, or what has become of it.

THE PHAROS OF ALEXANDRIA.

THIS structure was so famous that all lighthouses after it were called by the common name *Pharos*, from the island on which it stood. The tower was so high that it could be seen at the distance of a hundred miles. It cost Ptolomæus Philadelphus 800 talents, and was with justice considered one of the Seven Wonders of the World, not only on account of its grandeur, but utility; and dedicated to "the gods protectors of the safeguard of sailors."

It has been rebuilt; "but," says Mr. Lane, "the modern Pharos is a poor successor of the ancient building erected by Sostratus Cnidius, though from a distance it has rather an imposing appearance." Several Arab historians mention the telescopic mirror of metal which was placed at the summit of the ancient Pharos. In this mirror, vessels might be discerned at sea at a very great distance. El Makreezee relates that part of the Pharos was thrown down by an earthquake, in the year of the flight 177 (A.D. 793—4); that Ahnad Ibu-Tooloon surmounted it with a dome of wood; and that an inscription upon a plate of lead was found upon the northern side, buried in the earth, written in ancient Greek characters, every letter of which was a cubit in height and a span in breadth. This

was, perhaps, the inscription placed by the original architect, and which, according to Strabo, was to this effect: "Sostratus Cnidius, the son of Dexiphanes, to the protecting gods, for the sake of the mariners." It is also related by Es-Sooyootee, that the inhabitants of Alexandria likewise made use of the mirror above mentioned to burn the vessels of their enemies, by directing it so as to reflect the concentrated rays of the sun upon them.

The ancient Pharos was 450 feet in height, or 50 feet higher than St. Paul's Cathedral.

WONDERS OF TEMPERATURE.

Every one knows that there is no such separate existence as "cold." Cold is only an absence of heat; hence, when we require great cold, we must use some body which is demanding large quantities of heat. In a previous paper we described "latent heat," showing that every solid, to become a liquid, absorbed a large quantity of heat; that this heat was so pre-occupied in keeping the body in a fluid state that it could do nothing else, and refused to have any effect upon a thermometer placed in it. Just so with steam. Although the temperature of the steam as it issues from the spout of a kettle is just the same as that of the water, yet we know that, weight for weight, the steam contains more than five times the heat which is in the water. If, then, we require for any purpose a low temperature, we must force some solid to become a fluid, or some fluid to become a vapour.

The confectioners apply this principle in making "ices." The creamy preparation, placed in a metallic vessel, is immersed in broken ice mixed with salt. Now it happens that, for some unknown reason, salt and ice so act upon each other as to force the ice to liquefy, but this it is unable to do unless it has heat: this it abstracts from the cream, which consequently freezes. Two parts of pounded ice mixed with one of common salt can reduce the temperature 36 deg. below the freezing-point of water; or if, instead of the salt, three parts of crystallised chloride of lime be used, so low a temperature is produced that mercury will freeze. Yet, low as we can get the temperature by these "freezing" mixtures, it is nothing to the wonderful degree of intense cold which the vaporisation of some liquids can produce,

There is every reason to believe that gases are in reality liquids in vapour. Many of them, by being forced into a wrought iron receiver by means of a forcing-pump, can be liquefied. Of course, when the liquid is taken out of the receiver, and relieved of the enormous pressure under which it existed, it immediately endeavours to go back to its gaseous state. It is in a tremendous hurry to do this, and, seeing it is unable to become a vapour without it receives a large increase of heat, it commands all the surrounding bodies to deliver up their heat in the most peremptory manner. Laughing-gas, or nitrous oxide, so condensed under a pressure of 450 lb. on every square inch of the receiver which held the gas, and then liberated, can produce a temperature by its rapid evaporation nearly 200 deg. below the freezing-point of water; and, by causing this process to go on under the exhausted receiver of an air-pump, the greatest cold has been produced—very nearly 300 deg. below the temperature of ice.

But perhaps a more remarkable fact is this: that it is possible to cause extremes of temperature to exist in the closest juxtaposition. If some of the liquefied gas above mentioned be placed in a *red-hot* platinum crucible, and then a little water dropped on it, the water will go into ice. Imagine freezing in a red-hot crucible! nay, even mercury can be made to take the solid state under similar circumstances, and frozen mercury is so cold that when held in the hand it will blister it as though it had been a piece of red-hot iron. The reason that the liquefied gas was not instantly dissipated by the heat is the same as that which causes a drop of water to dance about on an almost red-hot plate of metal: the drop does not really touch the plate, but is surrounded by an atmosphere of vapour, upon a thin layer of which it rests, as shown on page 128 of this work. An ingenious application of this really wonderful fact has been long in use in glass-works. The mode of making British plate-glass is to blow a cylinder of glass, then cut it open and spread it out. To make the cylinder even and symmetrical, the glass is blown in a wooden mould, the sides of which are wetted with water; the red-hot glass converts this into steam, which keeps the glass from burning the wood, and also from touching the water, which would at once spoil it, rendering it brittle.

If possible, more wonderful, and indeed, all but incredible, is the finding of ice over which a lava-bed has been poured centuries ago. The ice first covered with a layer of cinders, which are bad conductors of heat, then came the molten lava; and the non-conducting power of the ashes proved sufficient to prevent the heat of the lava from melting the ice.

THE TARANTULA SPIDER.

This name is given to a large spider, observed at first in the neighbourhood of Tarentum, in Italy, and for the bite of which, considered poisonous, music and dancing were said to be the only remedy. Certain songs and airs were solemnly used for the occasion, and the tarantula itself danced to the air of the "tarantella." The truth is that the bite produced disorders of the nervous system, with strong convulsive movements, which was exaggerated into dancing. This disorder seems to have

occurred frequently in the kingdom of Naples during the sixteenth century; to have been nearly similar in its character to the disease which was originally called "St. Vitus' Dance;" and to that which has occasionally prevailed in parts of Scotland, and has been called the "leaping ague."

The patients, nearly all of whom were women, soon after being bitten, as it was supposed, used to fall into a stupor, from which nothing rescued them but the sound of such music as pleased them, on hearing which they had an irresistible desire to dance. So long as the music continued, and was in tune and sufficiently lively, they would go on jumping and dancing till they fell exhausted, and all the time some used to shriek, some to laugh and sing, some to weep. When, after a short rest, they had recovered from their fatigue, they would again begin to dance with as much vigour as before, unless the music were played slowly or confusedly, when they would stop and grow anxious or melancholy; or even, if the music were not soon made agreeable to them, would fall into a dangerous state of stupor. The disease used to last about four days, and seemed to be cured by the profuse perspirations brought on by the active exercise; but it often returned at the same time in the following year, or even for a succession of years, and on every occasion required the same treatment. The nervous affection was called the Tarantismus. Since it has been found that the bite of the tarantula can produce no such strange effects as these, many have suspected that the disease ascribed to it never really existed, but was feigned for the purpose of exciting pity, or for the pleasure of dancing. There is good reason to believe that in most instances it was merely counterfeited; but there can be no doubt that such a disease had occurred, and had given occasion to the practice of the fraud.

The habits of the tarantula are very curious. Its jaws and feet are large and strong; its legs and feet are furnished with long stiff spurs, with which the animal seizes its prey; and its foremost two pair of feet are furnished with a down, like a brush, which the tarantula employs in making its toilette, and in crawling on smooth surfaces; the feet are terminated by two strong nails. When full grown, it inhabits underground passages, forming a burrow sunk to the depth of a foot beneath the surface; and this burrow not only protects the animal from the pursuit of its enemies, but serves it as an observatory, whence it may dart on its prey. At first the hole sinks perpendicularly, then bends and forms an almost horizontal elbow, after which it resumes its direction downwards. At this elbow the tarantula stands sentry, never losing sight of the door of its dwelling; and here the creature's eyes glitter like diamonds, rendered bright, like those of a cat, by darkness. Externally, the opening of the tarantula's burrow is surmounted by a funnel, constructed of pieces of dry wood, united by clay, and lined with a web spun by the spider, which is continued through the whole interior of the burrow. This prevents the fall of earth, and enables the tarantula by its claws quickly to ascend or scale its fortress.

M. Leon Dufour has described the mode of hunting the tarantula, mostly in May and June, at Valencia, in Spain. The Apulian peasants imitate at the mouth of the hole the humming of an insect by means of an oaten stalk, and so lure the tarantula to the mouth of the burrow, and capture him. It is easily tamed. M. Dufour put two full-grown and very vigorous male tarantulas together in a glass vase, and then witnessed a combat fought with wonderful strategy, until the ferocious vanquisher mortally wounded his enemy in the head, and then devoured him.

BOILING BROTH IN THE HIGHER ANDES.

In Byam's "Wanderings in Chili and Peru," we find the following remarkable illustration of one of the well-known laws of heat:—"Feeling very cold, we determined to make some soup to warm us, and as we had plenty of meat and onions, we cut them up, put them into a saucepan with salt and Cayenne pepper, and set them on to boil. I only relate this for the information of those who have not been to great heights, those who wish to go there, and also of those who, perchance, may believe that boiling must be the same thing all over the world. After our soup had bubbled away in the most orthodox style for more than two hours, we naturally concluded that our 'bouillon' was ready and the meat perfectly done, especially as the last had been cut into rather small pieces; but, to our great surprise, we found the water almost colourless, and the meat almost as raw as when it was first put into the pot. One of the miners told us it was of no use trying to boil anything, as nothing could be cooked by water on the top of that mountain; for, although the water bubbled away very fast, the heat was not great enough to boil a potato.

"At great altitudes the water begins to boil long before it arrives at the heat of 212 deg. of Fahrenheit, and as water cannot get hotter than boiling-point, except by the compression of the steam, nothing can be cooked unless some safe means of confining the steam be adopted. I saw directly how the matter lay, and, sticking the lid tight on the pan, made it fast with heavy lumps of silver ore that were lying about, attaching them to the handle, and putting others on the top of all. In a very short time the steam got up, and, though it made the lid jump a little, I managed to get a good broth, to the great surprise of the miners, who could not conceive what I was about."

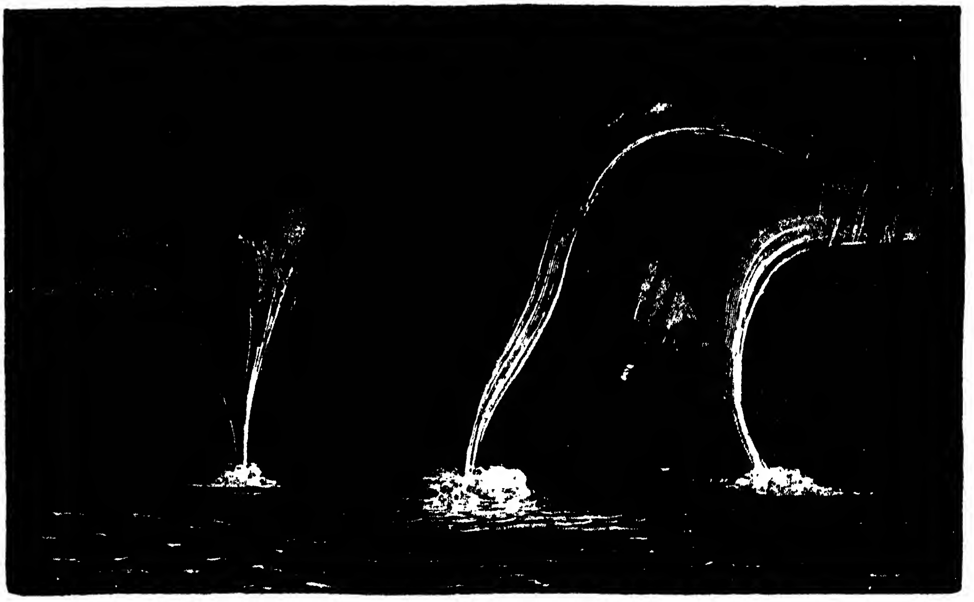
WATERSPOUTS.

WATERSPOUTS are among those curious phenomena of nature which have long been the subject of discussion with scientific observers, without any definite conclusion being arrived at as to their origin. Appearing in all countries of the world, they have attracted much attention and speculation, but no theory yet started to account for them has met general acceptance. Some have ascribed them to whirlwinds, others to electrical origin, and others, again, to a combination of both these causes. They are usually seen at sea in windy and cloudy weather, but occasionally appear in inland districts. In the latter case, however, there is generally water in the locality in the form of lakes and rivers.

Waterspouts at sea are usually formed in the following manner:—A dense cloud is seen to project from its centre a body of vapour, in form something like a sugar-loaf, with the apex pointing downward. This cone is agitated by the wind until it sometimes assumes a spiral form, and it gradually dips more and more toward the sea. As it approaches the water, a similar cone is seen to form upon the surface of the latter, with the point directed upwards, and both the clouds above and the waters below are evidently violently agitated by the influence at work to produce the phenomenon. Suddenly the descending and the ascending cones of water or vapour meet in mid-air, and form one united pillar, which traverses the sea with great velocity. The junction of the two cones is generally accompanied by an electrical flash.

After continuing in this form a short time, the waterspout bursts, in some cases with terrific violence, and to the destruction of anything in the vicinity. Many a ship has been overwhelmed in this manner, and sunk in a moment, with all on board. In November, 1855, five vessels were thus sunk by a waterspout in the harbour of Tunis.

It may be imagined, therefore, that the appearance of a waterspout at sea is often the cause of alarm to the mariner; but this is not always the case. Sometimes in stormy weather they are seen in the distance, forming and dispersing again with great rapidity, and a group of waterspouts may be observed at the same instant. But when a waterspout forms in the neighbourhood of a vessel, there is more or less of danger to the ship, in proportion to the size of the column; and it is customary in such cases to fire a cannon, in the hope that the concussion of the air may burst the spout before it arrives sufficiently near to swamp the vessel in its dispersion.



WATERSPOUTS AT SEA.

The whirlwind theory accounts for waterspouts in the following manner:—The winds meet from opposing quarters, and their mutual violence causes them to act and re-act upon each other, so that they travel round a common centre, neither current of air being sufficiently strong to overcome and pass the others. This whirling of the air causes a vacuum to be formed in the middle, and, according to the principle that "nature abhors a vacuum," the water or vapour from the clouds and that from the sea rush in to fill it, and remain united so long as the opposing forces in the air retain their balance of strength. This theory has at least the merit of

being easy of comprehension, but it is not in itself sufficient to account for all the circumstances attendant on the phenomenon, such as the manifest discharge of the electric fluid, which is so frequently observed. Therefore some have attributed it to a purely electrical influence between the water and the clouds in certain states of the atmosphere, although there is no sufficient knowledge of the modes in which this influence operates.

The waterspouts observed on land are cones or pillars of vapour which in many cases proceed from the clouds alone. One observed at Dum Dum, near Calcutta, was calculated to be about 1,500 feet in height; its duration was about half a minute, and on its bursting it covered half a square mile with about six inches of water. Waterspouts of this kind are often most destructive in their effects. Many such have been observed in this country, and we extract the following record of some of the most noteworthy from Townsend's "Manual of Dates:" —One burst in Lancashire in 1718, and caused considerable damage. Another, at Brackenthwaite, in Cumberland, September 9th, 1760, tore away the gravel and soil from a field. A great waterspout descended upon Dungavell Hill, in Scotland, July 2nd, 1768, and made an opening about twenty-four yards broad and three feet deep. A similar phenomenon occurred at Clapham Common during a violent thunderstorm, June 18th, 1782; and at Ramsgate, where it flooded several cellars to the depth of four feet, July 14th, 1798. One burst over the Wheal Abraham and Creuve mines, in Cornwall, in November, 1806, and choked up the shaft, causing the death of several miners, and considerable destruction of property. Another, consisting of a torrent of water nearly six feet in diameter, descended upon the town of Silkstone, in Yorkshire, May 9th, 1807, and several of the inhabitants were drowned. A waterspout of very destructive character overwhelmed the village of Kingscourt, county Cavan, Ireland, September 12th, 1838.

Waterspouts have occasionally been observed in the seas round the British coasts. In 1864 a remarkable one was seen in the Channel off Brighton. It lasted about a quarter of an hour, travelling with the wind, but dispersed without doing damage. Its duration was attended with thunder, and on its breaking up a heavy hailstorm swept over the locality.

CURIOUS METHOD OF POISONING.

"As in the Steppe," says Baron von Humboldt, "tigers and crocodiles fight with horses and cattle, so in the forests on its borders, in the wildernesses of Guiana, man is ever armed against man. Some tribes drink with unnatural thirst the blood of their enemies; others, apparently weaponless and yet prepared for murder, kill with a poisoned thumb-nail. The Otomacs often poison the thumb-nail with *curare*. A mere scratch of the nail is deadly if the curare mixes with the blood. We obtained specimens of the climbing plant from the juice of which the curare is prepared at Esmeralda, on the Upper Orinoco, but unfortunately we did not find it in blossom. Judging by its physiognomy, it appears to be related to strychnos. Richard Schomburgk found the plant in blossom in Guiana on the banks of the Pomeroon and the Sururu in the territory of the Caribs, who are not, however, acquainted with the manner of preparing the poison. Probably the curare or ourari poison does not kill by mere external absorption, but only when absorbed by living animal substance which has been wounded slightly, and its particular effect is to take away the power of voluntary muscular movement, whilst the involuntary functions of the heart and intestines still continue."

of Animal Life.

Serpents Changed into Rods.—The Egyptian cobra is unlike the Asiatic species, wanting the curious spectacle-like mark that distinguishes the latter. It is of a somewhat dark and greenish hue, marked with brownish, and attaining the length of from three to five feet. The Egyptian conjurers know how to render this serpent stiff and immovable by pressing the nape of the neck with the finger, and thus throwing it into a sort of catalepsy. The serpent is thus apparently converted into a rod or stick. Traces of this trick occur in Scripture, and it affords a striking illustration of the passage where Pharaoh's wise men cast down their rods, which were turned into serpents, but were devoured by the serpent of Aaron.

White Monkeys.—Pliny alludes to the fact that white monkeys are occasionally found in India; but it has generally been supposed that the specimens seen were albinos. Sir Emerson Tennent had one brought to him in Ceylon, which certainly could not have been an albino, as it had a black face and black eyes, all the rest of the body being white. He was told by the natives that this kind was not uncommon. Others are occasionally found entirely white, face and all. The Rev. R. Spence Hardy mentions in his work on "Eastern Monachism," that on the occasion of his visit to the great temple of Dambool, he met with a troop of white monkeys on the rock where the temple is situated. There can be no doubt of the fact, therefore, that white monkeys are really one of the varieties of the race.

Sagacity of Ants.—When Dr. Franklin was in Paris, as he sat quietly and alone at his breakfast one morning, he saw a number of black ants busy

with the contents of the sugar-bowl. He drove them away, but they returned. Again he dispersed them, but in a few minutes they were seen climbing from lump to lump, as if nothing had happened. To try their ingenuity, he had the sugar-bowl suspended by a string from the ceiling. They endeavoured to reach it by standing on each other's backs; several mounted in that manner and reached upwards, but in vain; the chain of ants fell down as fast as it was raised. After repeated attempts they went away, and he supposed they had given up the matter; but presently he saw them descending the string, and dropping down upon the lumps of sugar. They had scaled the walls, traversed the ceiling, and discovered another road to the treasure.

THE SPECTRUM ANALYSIS.

EVERY one must have observed the beautiful coloured image formed by allowing a ray of light to pass through a triangular-shaped bar of glass called a prism. Thus, suppose a ray of solar light, S, to fall upon a prism, A, allowing the image to

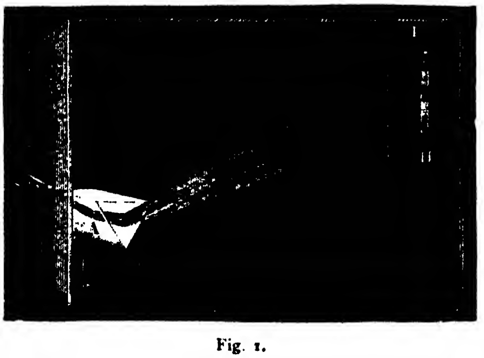


Fig. 1.

fall on a screen, we shall find that, instead of coming out in its original direction and appearance, we shall have it diverted and projected as a long streak of gorgeously-coloured light, I H. White light thus treated is said to be "decomposed," and the ray is said to be "refracted" from its original course.

Sir Isaac Newton was the first to notice this power of the prism, and hence came to the conclusion that ordinary light was composed of seven coloured rays united in one, each being of different refrangibility. The violet, being the most diverted or refrangible, is the farthest from the red, which is the least so; the other rays occupying intermediate positions. That such is the case may be proved in the following manner:—Having cut out a circular piece of cardboard, divide it, with a pencil, radially into portions varying in width proportionate to the space occupied by the colours in the "spectrum," as the band, I H, is called, and colour them with the seven primitive colours in the order in which they appear. These seven colours are called "primitive," from our inability, in the present condition of science, to further decompose them. When placed on a centre, and rapidly rotated, the coloured face of the card resolves itself into a dirty white, which would be pure if we could divide the card with perfect accuracy, and could also obtain pure prismatic colours.

A favourite theory with regard to the spectrum is that the primitive colours are three in number, blue, yellow, and red; the violet and indigo are shades of blue, the green is formed by the overlapping of the yellow and blue, and the orange is similarly produced by the commingling of the yellow and red.

Dr. Wollaston discovered in the year 1802 that the solar spectrum was crossed by dark, non-luminous bands, varying considerably in thickness and definition; he also observed that if the light of an electric spark were treated in a similar manner to the solar ray, the spectrum produced was found on examination to differ considerably from the solar spectrum in the arrangement of these lines. Herein lay the foundation of one of the greatest marvels of science.

Nothing more was done in the matter till the year 1815, when a German optician, Fraunhofer by name, devoted his attention to the study of this phenomenon. The immediate result of his investigation was important, showing that the solar spectrum, so far from being a continuous luminous band, was crossed by at least 600 dark lines, which have ever since gone by the name of "Fraunhofer's lines." The principal of these have been distinguished by the letters of the alphabet, as in Fig. 2. In 1835 Wheatstone discovered that the alteration of the metals forming the electrodes* varied the spectrum obtained by passing an electric spark between them, and the spectra so obtained were sufficiently distinctive to point out the metal composing them. Here, then, was the spectrum analysis fully developed: different substances gave different spectra. Plücker, in 1858, discovered that imponderable traces of gas could be discovered in this way.

To analyse the spectrum two things are essential—a good prism and a spectroscope. The latter is constructed as follows (see Fig. 4):—

To a pedestal, T, are fixed two arms, A A, one of which is so constructed as to move round the pedestal as a centre. To one arm is attached a telescope, B, to the other a tube, C, having at its further extremity a lens. The width of the orifice of the tube is regulated at pleasure by a sliding mouthpiece and screw, D; to the centre of the pedestal is fixed a prism, E.

* The "electrodes" are the terminations of the poles of an electric battery.

Everything is now ready, and the observer, taking some of the subject under examination, introduces it into the flame of a Bunsen gas-burner. The tube, C, and telescope, B, are now so arranged that the light from the burner passes down the tube, C, through the prism, E, where the ray is decomposed and refracted up the telescope, B, down which the observer looks. The spectrum is thus projected on to the retina, and may be easily identified by its own peculiar arrangement of "Fraunhofer's lines." Some more highly-finished spectroscopes are fitted with a third arm, the further end of which is closed by a ground-glass screen, on which is cut a fine scale; the other end of the tube is furnished with a lens; an independent light is placed opposite to this tube, and the bright lines of the scale are thus refracted through the prism and up the telescope, B, being thereby visible at the same time as the spectrum, by means of which the latter may be easily measured. Some instruments are arranged with two prisms at D, by which, using two burners, two subjects may be examined at the same time and their spectra compared. It is not always practicable to analyse the subject by a Bunsen's burner. If a metal, it may be made the electrodes of an electric circuit, and the light be obtained by means of an electric spark; or in some cases the burner of an ordinary lamp may be fed with an alcoholic solution of the subject. Certain subjects must be treated in certain ways.

To give some idea of the difference between the solar spectrum (Fig. 2) and other spectra, the spectrum of sodium is given in Fig. 3. It is more easily distinguished than perhaps any other metal, giving a brilliant, well-defined yellow line, coinciding in position with the line D of the solar spectrum.

Sodium, the base of our common soda, is so universally diffused, that it is almost, if not quite, impossible to obtain a spectrum in which the broad yellow band distinctive of the metal is not visible. Such a minute quantity as the $\frac{1}{2000000}$th part of a grain of this metal will give a spectrum. Bunsen and Kirchhoff have been the foremost pioneers in this branch of science, and their diligence has been rewarded by the discovery of two metals, till then unknown, to which they gave the names of cæsium and rubidium—the one called so from *cæsius*, sky-coloured, the distinctive spectrum of this metal being two blue lines; the latter from *rubidus*, dark red, this metal giving two remarkable red lines. Mr. Crookes, in 1861, added another metal, to which he gave the name of thallium, from θαλλὸς, a budding twig, alluding to the brilliant green line visible in its spectrum.

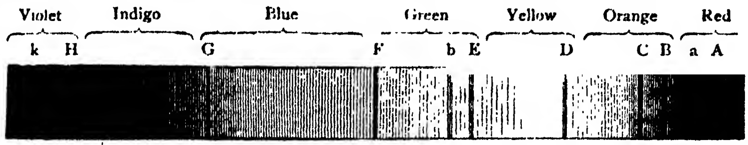


Fig. 2.

Fig. 3.

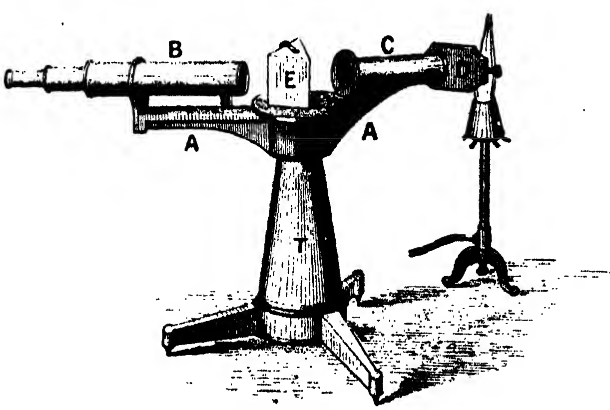


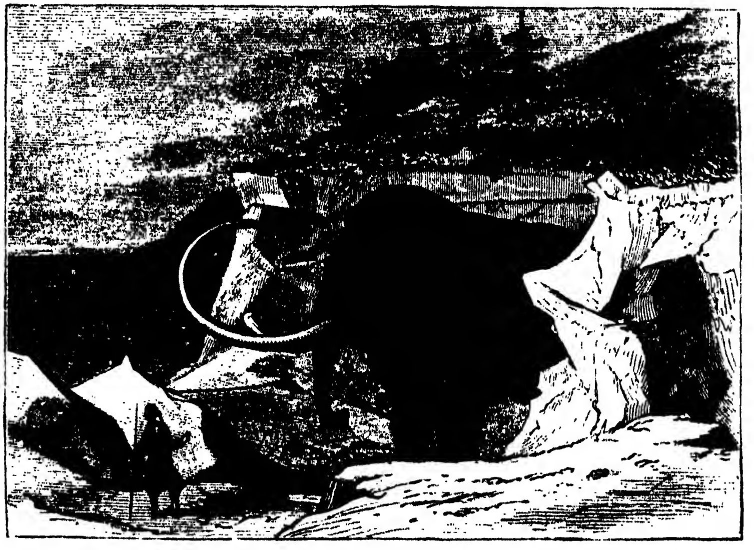
Fig. 4.

This minute analysis of bodies within our reach may seem wonderful, but a still more remarkable fact is that this method of analysis has been applied to the celestial bodies with great success, traces of our own metals appearing in the sun and in numbers of the stars. It has been observed, during a total eclipse of the sun, that that luminary appears to be surrounded by immense jets of gas in an incandescent state. It had been found impossible (on account of their light being overpowered in the usual condition of affairs) to investigate them, but recently the spectroscope has been applied to them, and although they are invisible, the observer can determine, by means of their spectra, the position and any fluctuations of these enormous flames.

THE MAMMOTH.

THERE is a vast country, of which Siberia forms a part, in the north of Asia, stretching from the mountains which separate Europe from Asia, and reaching as far as the straits which are between that continent and America. On the north of this region, which is larger than Europe, is the Polar Sea; and the great mountains—whose southern chain, the Himalayas, contains the highest peaks in the world—bound it on the south.

It is a dreary land, high and rocky on the south, and flat and frozen to the north. Some of the longest rivers in the world flow across it in a course nearly straight from south to north, and it is often warm and showery on the mountain sides when everything is frozen for hundreds of miles inland near the Polar Sea. Consequently, the water flowing down the long rivers meets the ice, floods it, and inundates the country for great distances; moreover, the gravel and stones carried down are piled on to the ice, and formed into sheets over the neighbourhood. In the year 1799, a chief of a native tribe was searching for ivory along the banks of the Lena, when, to his great horror and fright, he saw in a cliff of the gravel just mentioned a huge block of ice, and in it what he considered a beast of evil omen. He became ill from terror, but on his recovery, remembering that the beast had tusks which were like those he was searching for, he again visited the spot. There stood, all encased in transparent ice, a creature like an elephant in shape, nine feet high and sixteen long, and with enormous tusks projecting for eight or ten feet, and curving at their tips. The huge brute was hairy; it had long black bristles all over it, and they were from a foot to sixteen inches long; it had also long red hair covering the whole body, and short fur. The chief waited and watched for five years. By the end of that time the ice had melted, and the mammoth presented itself in its flesh and hairy hide to the astonished natives. The tusks were cut off and sold, the neighbouring inhabitants came with their dogs and feasted on the carcase, and the wolves picked the bones. Fortunately, a naturalist heard of it, and collected the bones and specimens of the hair, thirty pounds weight of which were gathered from the wet sand-bank on which the mammoth rested, and the tusks he repurchased. He carried the whole to the nearest capital, St. Petersburg, a distance of 7,330 miles, where it became one of the Wonders of the World, and where it may still be seen in the museum of which it forms a most remarkable feature. Our illustration shows the gigantic carcase as it appeared to the astonished eyes of the chief, still half encased in the ice-block which had preserved it for so many years.



DISCOVERY OF THE MAMMOTH.

The mammoth, or hairy elephant, is extinct, and a live one has never been seen since men have known how to read and write; but its bones are found over the whole of Europe, Northern Asia, and North America. The elephants now living are the African with large, and the Indian with small ears; these are both dwellers in hot climates, and would die if left to themselves even in the temperate countries of Europe. But the hairy mammoth was an elephant which lived in cold and temperate climates, and it is a most interesting creature, because its teeth, tusks, and bones, which

are by no means uncommon in old bogs, gravel-pits, and brick-fields, are often associated with the weapons of the first men who travelled from the East to colonise Europe, then a country full of wild beasts. It is supposed that the mammoth lived amongst the forests of the great plain of Siberia, and that it was often overtaken by floods and drowned. The carcases would float until covered with ice, gravel, and sand, and would generally decompose, and only the tusks and bones would be left. Thousands of mammoth tusks had been found in Siberia before the chief discovered the whole animal, and it is believed that there are as many more mammoths still covered up in Siberian gravel and mud as there are living elephants in India and Africa.

Doubtless the mammoth was larger than the elephant, but it fell beneath the constant attacks of savage men; and, moreover, it lived in regions where the rivers were constantly flooded and loaded with stony sediment, and where bogs were common. It died out very early in the history of man, but it lived when Europe was very different to what it is now. Many animals, some still living and others extinct, roamed through the country with the mammoth. There was a great tiger, a hyena, a rhinoceros covered with hair, the rein-deer, and many kinds of bears. These companions and enemies of the mammoth left their bones in the earth, and were either destroyed by men or died off from alterations in the climate. The mammoth had teeth which were coarser in structure than those of the elephant, and it fed upon tougher food; its hairy coat, so different from the skin of the existing elephants, adapted it for a cold climate, and its tusks are sold by the thousand for ivory. Even in North America, on the shore of Behring's Straits, the frozen cliffs of mud and sea break away and disclose ivory tusks and mammoth bones, and lately, in making explorations in Rome, mammoth bones were discovered in the mud by the side of the Tiber. Its teeth are common in England, and a great skull was found at Ilford, in Essex. An elephant fitted to live in a cold climate appears at first to be a very strange thing, but it must be remembered that the zebra can only live wild in hot climates, though the horse lives in cold; and the buffalo can only flourish in the warm countries, yet the ox, his near relation, does very well in Europe.

THE TEMPLE OF DIANA OF THE EPHESIANS.

At Ephesus, the capital of the twelve Ionian cities in Asia Minor, stood this famous temple of Diana. The edifice was burnt down on the night in which Alexander was born. It was set fire to by Eratostratus, a native of Ephesus, with no other view than to immortalise his name. His townsmen, however, passed a decree forbidding his name to be mentioned; nor would it soon have been known unless Theopompus had introduced it into his writings. Hence the incendiary has come down to our times as "the youth that fired the Ephesian dome."

Alexander made an offer to rebuild the temple, provided he could inscribe his name on the front, which the Ephesians refused. Aided, however, by the whole of Asia Minor, they erected a still more magnificent temple, which occupied them two hundred and twenty years. Pliny describes it as 425 feet long by 220 broad. Chersiphron was the architect. It was built of cedar, cypress, and even gold; and within it were treasured offerings to the goddess Diana, the value of which almost exceeded computation. Nero is said to have despoiled the temple of many of these treasures; but it existed until it was finally burnt by the Goths, A.D. 253—268. Vitruvius considers this temple as the first edifice in which architecture was brought to perfection, and the first in which the Ionic order was employed.

Ephesus, once the pride of Asia, is now represented by a poor village of a few cottages, and a castle and mosque built with fragments taken from the ruins of Ephesus, half a mile distant. The stadium, now converted into a corn-field, the theatre, the circus, and the magnificent gymnasium, may all be distinguished in outline, and their area is strewed with fine fragments. There is a particular part of the entablature of a Corinthian temple, which, in the richness and variety of its ornaments, as well as in their fine execution, has perhaps never been surpassed. But it is not without difficulty, and even doubt, that we can determine the spot where stood that proud boast of antiquity—the temple sacred to Diana of the Ephesians. All that constituted the splendour of this edifice—its columns, of which 127 were the gifts of kings, its works of art, comprising the masterpiece of Apelles and Praxiteles, and the one column sculptured by Scopas—have disappeared. After the temple had been repeatedly pillaged by the barbarians, Justinian removed the columns to adorn the church of St. Sophia, at Constantinople. The temple site can now be identified only by the marshy spot on which it was erected, and by the prodigious extent and magnitude of the arches raised as a foundation. The vaults formed by them compose a sort of labyrinth. There is not an apartment entire; but walls of immense blocks of marble, in the fronts of which are perforations wherein were sunk the shanks of the brass and silver plates with which the walls were faced—these, and shafts of columns, are all that remain of this splendid edifice, once pointed out as that which all Asia worshipped when the people cried out in their enthusiasm, "Great is Diana of the Ephesians, to whom such a temple belonged!"

INTELLIGENCE IN THE HORSE.

In Stephens's "Book of the Farm" the following examples of equine intelligence are recorded:—"It is remarked by those who have much to do with blood-horses, that when at liberty, and seeing two or more people standing conversing together, they will approach, and seem, as it were, to wish to listen to the conversation. The farm-horse will not do this, but he is quite obedient to call, and distinguishes his name readily from that of his companions, and will not stir when desired to stand till his own name is pronounced. He distinguishes the various sorts of work he is put to, and will apply his strength and skill in the best way to effect his purpose, whether in the threshing-mill, the cart, or the plough. He soon acquires a perfect sense of his work. I have seen a plough-horse walk very steadily towards a directing pole, and halt when his head had reached it. He seems also to have a sense of time. I have heard a horse neigh almost daily about ten minutes before the time of ceasing work in the evening, whether in summer or in winter. The horse is capable of distinguishing the tones of the voice, whether spoken in anger or otherwise, and can even distinguish between musical notes. There was a work-horse of my own who, even at his corn, would leave off eating and listen attentively, with pricked and moving ears and steady eyes, the instant he heard a low note sounded, and would continue to listen so long as it was sustained; and another that was similarly affected by a particular high note. The recognition of the sound of the bugle by a trooper, and the excitement occasioned in the hunter when the pack give tongue, are familiar instances of the power of horses to discriminate between different sounds. They never mistake one call for another."

THE SPEAKING-TRUMPET.

The ancient contrivances of this kind resembled hearing rather than speaking-trumpets. The great horn described in an old manuscript in the Vatican Library as having been used by Alexander the Great to assemble his army, has been considered the oldest speaking-trumpet on record; but the description does not expressly state that Alexander *spoke* through the horn.

To Sir Samuel Morland, Master of Mechanics to Charles II., we are indebted for the speaking-trumpet in its present form. Athanasius Kircher, the learned Jesuit, warmly contests the credit of the invention, asserting that he had published the description of a speaking-trumpet several years before Morland described his invention in a pamphlet of eight pages, published in 1671. But Kircher's work resembled a hearing-trumpet, and he does not appear to have tried a proper speaking-trumpet until two years after Morland's trumpet had appeared.

To Sir Samuel Morland must, therefore, be awarded the priority of the invention. His pamphlet is entitled "A Description of the Tuba Stentorophonica, an instrument of excellent use, as well by sea as by land." In this rare tract he gives an account of the various experiments that he made before his instrument attained a certain degree of perfection. The first trumpet that he constructed, "although," says Sir Samuel, "the invention had been long before digested in my thoughts," was made of glass in the year 1670, being about two feet eight inches in length, the diameter of the greater end eleven inches, and that of the other end two and a half inches. "With this," he says, "I was heard speaking at a considerable distance by several persons, and found that it did very considerably multiply the voice." After giving a description of some experiments with other trumpets, he enters into a philosophic disquisition on the nature of sound, and the best form of the speaking-trumpet, which he leaves doubtful; and concludes with "an account of the manifold uses" of his instrument, which are very excusably exaggerated.

The next trumpet he made was of brass, twelve inches in diameter at the large end and only two inches at the small end, to which was affixed a mouth-piece, "made somewhat after the manner of bellows," to move with the mouth, and thereby prevent the escape of the breath. This was tried in St. James's Park, and rendered the voice audible at a distance of nearly half a mile. The third instrument was of copper, recurvod in the form of a common trumpet; its total length was sixteen feet eight inches, the large end nineteen inches, and the small end two inches in diameter; with this the voice was heard about a mile and a half. Morland made other trumpets. With one of the largest, tried at Deal Castle, the voice was conducted a distance of between two and three miles over the sea. Morland appears to have overrated the power of his trumpet; for in his "Urim of Conscience" he says that he has no doubt but that it might be improved so as to carry the voice for the distance of ten miles! Dr. Young, by the way, records that at Gibraltar the human voice has been heard at a distance of ten miles.

In an advertisement prefixed to a French translation of his pamphlet, it is stated that Morland's "tubes," as they were called, were sold by Moses Pitt, a bookseller, in St. Paul's Churchyard, at the price of £2 5s. The invention excited much interest at the time. Butler makes Hudibras say:

> "I heard a formidable voice,
> Loud as the Stentophonic noise."

There is one of Morland's original tubes now

preserved in Trinity College Library, Cambridge. This trumpet is about six feet long; it is in bad condition, and no one knew what it was until about thirty years since, when it was identified by a member of the college.

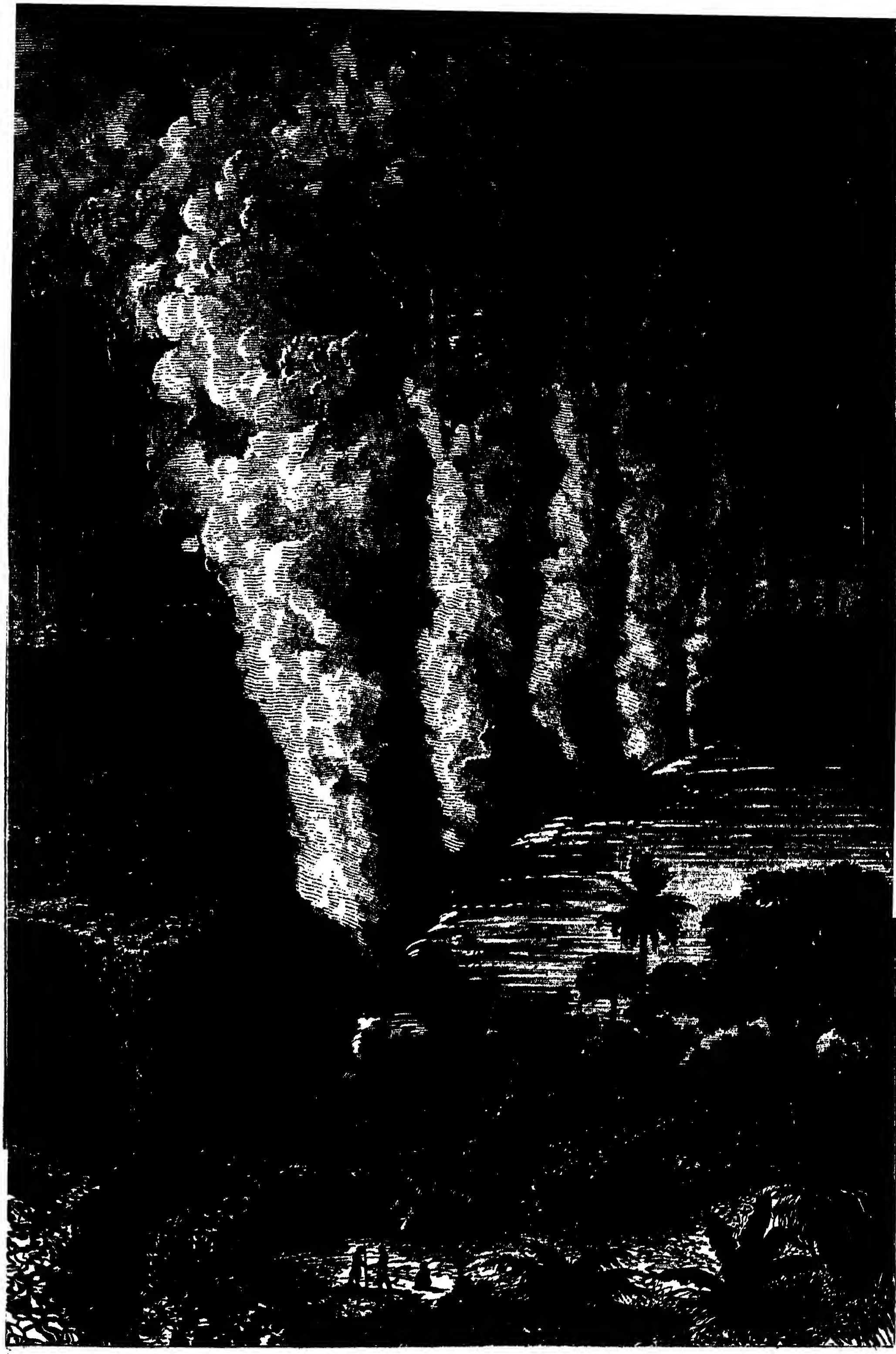
WONDERFUL WATERFALLS.

WHEN Dr. Livingstone, the celebrated African explorer, reached the river Zambesi, he often was asked by the natives, "Have you smoke that sounds in your country?" and they assured him that some way off "smoke did sound." He went in the direction pointed out by the natives, and whilst sailing down the river Zambesi, saw, at a distance of five miles, vast columns of what looked like the smoke caused by burning large tracts of grass. There were five columns, which bent with the wind, and their tops appeared to blend with the clouds; they were white below, and higher up became dark, so as to appear like smoke. There was a dull roaring sound, which was heard as far as the columns were visible. Livingstone pulled down the river, and came upon the most gigantic waterfall ever seen; and he found that the smoky columns that sounded were vast masses of vapour and spray hurled upwards for hundreds of feet above the level of the water, and that the sound was caused by the deafening rush of a vast river over a great precipice. After risking himself in a small canoe, Livingstone got upon an island just above the falls, and creeping with awe to the verge, he peered down a large rent in the earth which had been made from one side of the river to the other, and saw a stream a thousand yards wide tumbling down a hundred feet. There was no great river flowing straight away from the bottom of the falls, for the other side of the rent was not more than eighty feet from where the river jumped down; consequently, all this vast rush of foaming water, after a fall of 100 feet all surging and bubbling, could find no stream in front and only a moderate opening on one side. The great fissure down which the Zambesi falls is in hard rocks, which are quite perpendicular; and on looking into it nothing but a dense white cloud could be seen. From this cloud rushed up a great jet of vapour, exactly like steam, and it mounted 200 or 300 feet high; there condensing, it changed its hue to that of dark smoke, and came back in a constant shower. This shower falls chiefly on the opposite side of the fissure, and a few yards back from the top there stands a straight hedge of evergreen trees, whose leaves are always wet. From their roots a number of little rills run back into the gulf, but as they flow down the steep well there, the column of vapour, in its ascent, licks them up clean off the rock, and away they mount again. They are constantly running down, but never reach the bottom. Two bright rainbows were seen in the vapour, and the grandeur and sublimity of the scene were increased by the beauty of the surrounding country, for the everlasting spray fertilised the soil, and the forest trees, with their tropical underwood, clothed the banks for miles. When the falling water reaches the bottom of the fissure it is compressed, for there is not so much space there as above, and the rent is not more than sixty feet wide down below. The five columns ascending from this abyss are formed in consequence of this compression. One side of the fissure is said to be very much deeper, and there is one part where the walls are so sloping that people accustomed to it can go down. The river looks then like a white cord at the bottom of a precipice 300 feet in depth. Livingstone named this wonderful cataract the Victoria Falls.

The celebrated Falls of Niagara, in North America, are situated between Lake Erie and Lake Ontario, which are about thirty-three miles apart. Lake Erie is 334 feet higher than Lake Ontario, and when the river Niagara leaves the first-named lake it is about a mile wide, and the current is gentle, hardly exceeding two and a half miles an hour. About ten miles down, the river is two miles wide; and a little lower down, at the mouth of the Wolland river, it suddenly contracts to less than a mile, and its current rapidly increases from three to seven or eight miles an hour. The bed of the river descends here at a considerable inclination, so that its banks are high on each side, rising upwards from twenty to fifty feet above the surface of the water. The river separates Canada, which is on the north, from the United States of America on the south. The waters of this great river are borne down with tremendous force against the Canadian side, and are driven back by the rocky banks, and after giving a slight twist to their course, they are hurled down over a perpendicular height of 160 feet into a terrific gulf.

Goat island, which is 320 yards wide, divides the cataract; and the water-fall between it and the American side is 320 yards wide and 162 feet high. Between the island and the Canadian side the falls are 700 feet wide and 152 feet high. Both falls unite before they are lost in the abyss below. Below the falls, the river, foaming with agitated waves, rushes along between banks which are nearly perpendicular, and between 200 and 300 feet high. They are, however, only between 200 and 400 yards apart, and the violence of the stream is increased by this narrowing of its breadth. Four miles below the falls there is a terrific whirlpool formed by the water, which descends into a deep, basin-shaped place with great velocity, and then passes forth to flow into Lake Ontario.

In bright summer weather the beauty of the rainbows produced by the action of the sun upon the great volumes of spray which rush up from below



FALLS OF THE ZAMBESI.

See page 236.

the falls, is beyond conception, and the rocky shores with the islands above render the scene very grand. The rush of the waters is so rapid, and their volume is so enormous, that the more the fall is examined the more gigantic does it appear. As the day advances the shadows alter their position, and the light falls upon different parts of the plunging tide, so that there is an ever-changing view of this fine cataract. In winter the spectacle is no less wonderful. There is a deep blue sky, and everything near is covered with snow; and the view of the grotesque and gigantic icicles hanging to the rocks, and of the masses of ice tumbled over the fall, and struggling, as it were, in the pool at its foot, are sights never to be forgotten. At one spot, the cliff over which the river falls is worn away so that the top overhangs; consequently, there is a passage between the rock and the awful plunge of water, which is occasionally visited. It is very evident that this cliff wears away, and every now and then pieces of it fall. If the steep cliffs on either side of the river, between the falls and Lake Ontario, into which it rushes, are examined, no one can doubt that the cataract was once near this lake, and that it receded during a vast period of time to its present position by the gradual wearing away of the rocks.

THE ESCAPES OF MANUSCRIPTS.

OUR ancestors were great hiders of documents. Dr. Dee's singular MSS. were found in the secret drawer of a chest which had passed through many hands without being discovered; and that vast collection of Thurloe's (the secretary of Cromwell), which formed about seventy volumes in the original manuscript, accidentally fell out of the false ceiling of some chambers in Lincoln's Inn.

Sir Robert Cotton, one day at his tailor's, discovered that the man was holding in his hand, ready to cut up for measures, an original Magna Charta, with all its appendages of seals and signatures. This anecdote is told by Colomiés, who long resided in this country, and an original Magna Charta is preserved in the Cottonian library exhibiting marks of dilapidation.

Cardinal Granvelle left behind him several chests filled with a prodigious quantity of letters written in different languages, commented, noted, and underlined by his own hand. These curious papers, after his death, were left in a garret to the mercy of the rain and the rats. Five or six of these chests the steward sold to the grocers. It was then that a discovery was made of this treasure. Several learned men occupied themselves in collecting sufficient of these literary relics to form eighty thick folios, consisting of original letters by all the crowned heads in Europe, with instructions for ambassadors, and other state papers.—*Disraeli's "Curiosities of Literature."*

"DOMESDAY BOOK."

AMONG the public and historical records of this country there is none more interesting and curious than the ancient manuscript which is known by the name of "Domesday" or "Doomsday Book." It consists of an account, compiled by order of William the Conqueror, of all the lands and estates throughout the greater part of England, with their ownership both before and after the Norman Conquest; the conditions of the holding, the number of tenants, the character of the land, &c. The name by which it is known is ascribed to various sources. By some it is considered to refer to the "day of doom," or day of judgment, in allusion to the fact that it was intended to last as a permanent record of the apportionment of the country among William's followers. By others, again, it has been traced to the Celtic *dom* ("a lord") and *deya* ("a proclamation"), hence meaning the king's proclamation or advertisement to the tenants who held land under him. Lastly, and perhaps most probable, is the account given by the old chronicler, Stowe, that the word "Domesday" was simply a corruption of *Domus Dei* ("God's house"), which was the name of the apartment in the Treasury where the book was kept in former times.

"Domesday Book" is now in the Public Record Office in London. It is in two volumes, the larger comprehending the survey of the chief counties of England, with the exception of the most northern (which were omitted from the record) and the three eastern counties—Essex, Suffolk, and Norfolk. These last are included in the second and smaller volume of the book. The returns are all recorded in the Latin tongue, with many abbreviations; the character in which they are written is the old English text, and the style of the writing is remarkably neat and legible.

As an example of the contents of the book, we extract the following translation of a passage in the smaller volume, referring to the hundred of Beventre, in Essex:—"Essex, the king's land; the hundred of Beventre. Harold held Haveringe, in the time of Edward the Confessor, for 1 manor and 10 hides. Then there were 41 villeins, now 40; there were always 41 bordars,* and 6 slaves, and 2 carucates† in demesne, on the lord's lands; there were 41 carucates among the men, now 40; wood sufficient for 500 hogs, 100 acres of meadow; now 1 mill, and 2 working-horses or pack-horses, and 10 young growing beasts, 160 hogs, and 269 sheep. To this manor there belonged 4 freemen, who had 4 hides in the time of Edward the Confessor, paying an accustomable rent; now Robert, son of Corbutio, holds 3 of those hides, and Hugh Mont-

* Cottagers. † A measure of land.

fort the fourth, and have paid no rent since they held them. This manor was worth, in the time of King Edward, 36 pounds, now 40; and Peter the viscount receives from it 80 pounds for rent, and 10 pounds for an income or fine."

The survey was commenced in 1085, and the "Anglo-Saxon Chronicle" thus records the proceedings:—"The king had a great consultation (at Gloucester), and spoke very deeply with his witan concerning this land, how it was held, and what were its tenantry. He then sent his men over all England, into every shire, and caused them to ascertain how many hundred hides of land it contained, and what lands the king possessed therein, what cattle there were in the several counties, and how much revenue he ought to receive yearly from each. He also caused them to write down how much land belonged to his archbishops, to his bishops, his abbots, and his earls; and—that I may be brief—what property every inhabitant of all England possessed in land or in cattle, and how much money this was worth. So very narrowly did he cause the survey to be made, that there was not a single hide nor a rood of land, nor—it is shameful to relate that which he thought no shame to do—was there an ox, or a cow, or a pig passed by, and that was not set down in the accounts; and then all these writings were brought to him." The work was completed in 1086.

The book as a whole forms a most striking record of the complete subjugation and despoilment of a nation by its ruthless conquerors. Many of the entries illustrate forcibly the degradation into which the Saxon people had fallen as a consequence of William's success. The roll shows that freemen were not only counted by the head, but sold, given away, or lent among the Norman rulers. Thus in one place it is recorded that King William had lent the Saxon Edwig to Raoul Taillebois, to keep him as long as he lived; in another, that a certain viscount had in the town of Ipswich two Saxon burgesses—one in pledge, and the other for debts; and a Saxon was sometimes the property of two Norman chieftains in half-shares. Sometimes, as a very special favour, particular Saxons were allowed to hold small possessions as "an alms," or to retain their land on conditions which involved an indignity. Thus, one woman was allowed to enjoy her husband's estate on condition of feeding the king's dogs. A mother and son received their ancient inheritance as a gift, on condition of their offering up prayers daily for the soul of Richard, the king's son.

The book in which all these particulars are recorded has been considered an invaluable historical monument, such as is possessed by scarcely any other nation. Its preservation for 800 years is itself a remarkable fact, and almost suggests the idea of endurance conveyed in its familiar title.

THE INDIAN THUGS.

We have given an account of one of the wonders of Eastern fanaticism in the case of the Indian Fakirs, and have now to speak of another even more terrible—namely, that of the Thugs of the same country. In the Fakirs, fanaticism leads merely to self-torment and imposture; but in the Thugs we see it making treacherous and systematic war upon the rest of the human race.

The word *Thug* is of Hindoo origin, and means deceiver; but in the southern provinces of India the same people are called *Phunsigars*, which has the more significant sense of *stranglers*. The Thugs form a class among themselves, their identity being concealed even from other Hindoo castes and religious fraternities. They are professedly worshippers of the goddess Kali, wife of Siva, the destroying power, according to the Hindoo mythology. In her honour they profess to set themselves apart as instruments of destruction, and they deem it highly meritorious to murder any unsuspecting person who may fall in their path, whether man, woman, or child.

Robbery forms a kindred element and a further incentive to their highest crimes. To waylay unsuspecting travellers, and even whole caravans of merchants, to strangle them and carry off their booty, forms the height of their ambition; and they frequently amass considerable wealth in so doing.

With so much secresy are the operations of the Indian Thugs carried on, that when the Government under Lord William Bentinck, in 1828, were actively engaged in suppressing them as far as possible, it was frequently found that many of the Thugs were in the habit of carrying on trade in the principal towns, whence they would occasionally start on an expedition of *Thuggee*, as their fearful pursuit is called. They would return from these expeditions with goods and merchandise, which it was believed by their neighbours were obtained from afar in the legitimate operations of their business; and the greatest consternation was often created in the places where they resided by the discovery of their real character as Thugs, which had never been suspected, even by the peaceful Hindoos around them.

Others, and sometimes entire families and tribes, would carry on the operations of agriculture, remaining equally unknown to the people immediately around them. For none but those whose ancestors were Thugs are admitted into this horrible fraternity, the profession being carried on from generation to generation, and confined to the descendants of Thugs as rigidly as other avocations in the general Hindoo law of *caste*.

It is a singular fact that Europeans had been long in India before the existence of Thugs, in

their real character, was ever suspected. It was not until towards the close of the last century that this true character was ascertained by the English authorities. That gangs of robbers, unscrupulous as to the sacrifice of life, existed in all parts of India, was well known; but it was never imagined that these were part of an hereditary organisation which deemed the destruction of human life its chief religious duty. One of the earliest travellers who gave any account of them was a Frenchman named Thevenot, although he was not aware that they were a professedly religious fraternity. He thus described their operations:—

"One had best have a care of robbers, and, above all things, not to suffer anybody to come near one upon the road. The cunningest robbers in the world are in that country. They use a certain slip with a running noose, which they can cast with so much sleight about a man's neck when they are within reach of him, that they never fail, so that they strangle him in a trice. They have another cunning trick, also, to catch travellers with. They send out a handsome woman upon the road, who, with her hair dishevelled, seems to be all in tears, sighing and complaining of some misfortune which she pretends has befallen her. Now, as she takes the same way that the traveller goes, he easily falls into conversation with her, and, finding her beautiful, offers her his assistance, which she accepts. But he hath no sooner taken her up on horseback behind him, but she throws the snare about his neck and strangles him, or at least stuns him, until the robbers, who lie hid, come running to her assistance, and complete what she hath begun. But besides that, there are men in those quarters so skilful in casting the snare, that they succeed as well at a distance as near at hand; and if an ox or any other beast belonging to a caravan run away, as sometimes it happens, they fail not to catch it by the neck."

The practice of strangulation by means of a running noose was the mode of assassination adopted by the Thugs of all parts of India. The office of strangler is, according to Thuggee law, the highest honour to which a man can attain. We are told by Colonel Sleeman that, "After a man has passed through the different grades of Thuggee, and shown that he has acquired sufficient dexterity, or what we may call nerve or resolution, and which they call 'hard-breastedness,' to strangle a victim himself, the priest, on a certain day, before all the gang assembled, before they set out on their criminal expeditions, presents him with the *angocha* or *romal* (the handkerchief with which the strangling is performed) tells him how many of his family have signalised themselves by the use of it, how much his friends expect from his courage and conduct; and implores the goddess to vouchsafe her support to his laudable ambition and endeavours to distinguish himself in her service. The investiture of the *romal* is knighthood to these monsters; it is the highest object of their ambition, not only because the man who strangles has so much a head over and above the share which falls to him in the division of the spoil, but because it implies the recognition by his comrades of the qualities of courage, strength, and dexterity which all are anxious to be famed for."

The bodies of the victims are usually disposed of immediately by burial, or, if time will not allow of this, by being thrown into watercourses or jungles, and thus no trace of murder is left upon the road. In the burial, the Thugs use an implement called the "sacred pickaxe," which is prepared with much ceremony, and held in high veneration. If the pickaxe should drop from the hands of the sexton Thug while in use, it is regarded as a terrible omen of calamity to the tribe.

It was computed thirty years ago, when the Government were trying to root out the Thugs, that at least from 1,000 to 1,500 people annually lost their lives by Thuggee. In the years 1826 to 1835 more than 1,500 prisoners were tried for this crime, and 1,400 of these were either hanged or transported for life. But the ramifications of Thuggism extended too far for effectual suppression, and even at the present day the Thugs still infest the roads traversed by pilgrims in the more remote parts of India.

GREEK FIRE.

"GREEK FIRE"—or, as it was sometimes called, "Saracen fire"—was the most important war material men had before the invention of gunpowder. Twice the city of Constantinople was saved by the use of it. It is said to have been invented by a Syrian, who, deserting from the service of the caliph, revealed his secret to the emperor. The ingredients, if not also the mode of darting the fire, were kept a secret for upwards of 400 years, and it is quite uncertain now what were actually the component parts of that which, Joinville says, "came flying through the air like a winged, long-tailed dragon, about the thickness of a hogshead, with the report of thunder and the velocity of lightning; and the darkness of the night was dispelled by this deadly illumination." It is generally considered, however, that "the fire" was composed of naphtha, mingled in certain proportions, now unknown, with sulphur, and with pitch obtained from evergreen fir. This mixture, ignited and blown or pumped through long tubes of copper, which were mounted in the prows of galleys, and fancifully shaped into the form of monsters, produced a thick smoke with a loud explosion, and a flame, fierce and obstinate, which no amount of water could put out. When used for the defence of walls, it was

poured in large boilers from the ramparts, or was hurled on javelins by means of tow which had previously been steeped in the inflammable material. Against it the bravest soldiers went in vain; their imagination recoiled from a thing so subtle and terrible. Horses fled from it in dire fright; ships were burnt by it; there was no way of standing against it.

The Greek emperors, sensible of the enormous advantage which an offensive weapon of such a kind gave them, invested it with a mysterious history, and appealed to the superstition of their subjects for the preservation of the secret of the manufacture. They said that an angel had revealed the composition of Greek fire to the first Constantine, for the express purpose of maintaining the superiority of the empire over the Barbarians; and that whoever betrayed the secret to foreigners would incur not only the penalties of treason and sacrilege, but the special vengeance of the Almighty. In the twelfth century, however, we find it used by the Mahometans in their wars with the Christians; and from that time it came into pretty general use, until the invention of gunpowder put it out of date, and caused an entire revolution in the art of war.

Wonders of Animal Life.

Sense of Hearing in Seals.—Captain Thomas Brown, in his "Anecdotes of Quadrupeds," makes the following remarks on this subject:—"These animals (the *Phoca vitulina*) have a very delicate sense of hearing, and are said to be much delighted with music. The fact was not unknown to the ancient poets, and is thus alluded to by Sir Walter Scott—

> Rude Heiskar's seals through surges dark
> Will long pursue the minstrel's bark.

Mr. John Laing, in his account of a voyage to Spitzbergen, mentions that the son of the master of the vessel in which he sailed, who was fond of playing on the violin, never failed to have a numerous auditory when in the seas frequented by seals; and Mr. Laing has seen them follow the ship for miles when any person was playing on deck. It is a common practice in Cornwall, when persons are in pursuit of seals, as soon as the animal has elevated its head above water, to halloo to it till they can approach within gunshot, as they will listen to the sound for several minutes. I have seen this method pursued by the fishermen at Newhaven."

The Natural Clothing of Animals.—The clothing which grows from the bodies of animals is always suitable in quality and quantity to the climate and season under which they live. In hot climates the coat of quadrupeds is short and thin, but it thickens with increasing latitudes, and yields soft and abundant fleeces. At the poles it is externally shaggy and coarse, internally shorter and fine, as in the skin of the Arctic bear. How defensive is the fur of amphibious animals, the beaver, for example! How abundant and smooth upon birds are feathers, shutting up the heat of their warm blood, and opposing no resistance to the air through which they fly! The birds of very cold regions have plumage almost as bulky as their bodies; and those which live much in the water have additionally both a defence of oil on the surface of the feathers, and the interstices of the ordinary plumage filled with delicate down—a bad conductor, which abounds particularly on the breast, as it, in swimming, first meets and divides the cold wave. Then there are animals with warm blood which live in the water—for example, the whale, seal, and walrus; but neither hair nor feathers oiled would have been a fit clothing for them. They accordingly derive protection from the cold water by the enormous amount of blubber or fat which surrounds their bodies, and acts as a non-conductor.—*Dr. Arnot.*

A Magpie's Amusement.—There is a story told of a tame magpie which was seen busily employed in a garden gathering pebbles, and, with much solemnity and a studied air, dropping them into a hole about eighteen inches deep, made to receive a post. After dropping each stone, it cried "Currack!" triumphantly, and set off for another. On examining the spot, a poor toad was found in the hole, which the magpie was stoning for his amusement.—*Thompson's "Passions of Animals."*

EFFECTS OF VIOLENT WIND.

The power of violent wind, when accompanied by rain, to say nothing of snow and frost, in exhausting the physical powers, is little appreciated, and would hardly be believed if certain evidence of it did not exist. The chilling effect of a current of air is familiarly known. Arctic travellers have no difficulty in bearing a cold of thirty or forty degrees below zero if the atmosphere be perfectly still; but the smallest wind, with a temperature even of zero, is almost insupportable. Even in the temperate climate of Great Britain, and at very moderate elevations, not unfrequent cases of death from exposure have come to our knowledge which have taken place in the summer months. One remarkable instance occurred in August, 1847. Two Englishmen travelling on foot by a well-marked road from King's House to Fort William in Scotland, during a storm of wind and rain—violent, yet not excessively cold, and without a flake of snow—sank down and died on the path. Similar instances have happened of late years in Westmoreland.—*Quarterly Review.*

AN ANT-HILL.

WONDERS OF ANT LIFE.

EVERY one is familiar with the common ants, which are to be met with all over the country. The ant is a small insect; about twenty of them could stand together on a threepenny-piece. It is very fond of the society of its kind, and where one is seen, others are generally not far distant. Like our common bee, they live in large communities.

The ant-hill, the residence of these communities, is a wonderful construction, made of earth. It is about the form and size of a washing-basin turned upside-down, and contains within it innumerable chambers and galleries, made by the energy and industry of its little inhabitants. If a small piece of this house be broken, and the interior examined, it presents a scene of wondrous activity. Some ants rush hither and thither; some seize the eggs which have been exposed, and hurry with them to a place of safety; others apply themselves to repairing the breach. While thus engaged, the ants, on meeting, are often observed to stop, and, touching each other with their feelers, apparently have the power of communicating their ideas.

Wonderful are the observations which have been made about these little animals; not the least of them is the discovery that some ants keep what may be called milch cattle. This fact has, however, been proved by its discoverer, M. Huber.

There is a small insect inhabiting trees, and the leaves and stems of plants. It is well known in green-houses, where its presence is greatly detested by gardeners, who use all means in their power to get rid of it. This little insect, called the aphis, is the milch cow to which the ants are indebted for an important part of their sustenance. At certain times of the year the plants tenanted by the aphis are frequented by multitudes of ants, their object being to obtain a fluid which is secreted in the body of the aphis. This fluid, scarcely inferior to honey in sweetness, comes from them in drops, and is eagerly sought by the ants. The aphis, with its mouth fastened into the bark of the tree, is continually drinking in the sap, which, after having passed through its body, comes out as this sweet fluid. An ant is seen to caress an aphis with its feelers, and immediately the latter yields a drop of its honey, which is greedily swallowed by the ant.

More than this, by common consent it appears to be arranged that the aphides on a particular branch shall belong to the ants of a particular nest, and any other ant intruding on their preserves is

treated with summary justice. The ants love their useful allies, will defend them from aggression, and may be seen to carry them about in their mouths. Some kinds of ants treat their cattle in a still more curious way—they keep them in their own nest and supply them with their necessary food. When the aphis lays eggs the ants undertake the charge of them, bringing them out to the sun, and moistening them with their tongues, thus using all means to increase their stock of cattle by successfully hatching the eggs.

Such valuable property as the aphides are naturally tempt the attacks of robbers. Tenants of a neighbouring hill often make a raid with a view to capture them, and their owners fight for them with valour, knowing as they do how essential to the life of the colony is their stock of milch cattle.

Wonderful Fish.

THE PILOT-FISH.—Ligon, writing in 1657, mentions a pilot-fish which was captured with a shark by his ship's company. "This little guide of his swims sometimes a yard before him, sometimes more or less, at his pleasure; and in his greatest adversity often cleaves to him, and, like a dear friend, sticks closest when he needs him most; for when he is taken, this little fish never fails to fasten himself to his head, or some part near that, and resolves to die with him. The experience of this we formed not only in this great fish, but in all the rest we had formerly taken, for we never took the one without the other."

THE SHOOTING-FISH.—This aquatic sportsman, a native of the East Indies, derives its name from the somewhat novel but wonderful way in which it provides its daily food. Nature has provided it with a hollow cylindrical tube, which it uses in the following manner:—On observing an insect on a reed, or other substance overhanging the water, it retires to a distance of between five and six feet, and after appearing to take careful aim with its tube, ejects from it a single drop of water with such surprising force and accuracy, that the insect is invariably precipitated into the water below, where the keen eye of the shooting-fish soon detects it, and ends its unfortunate career.

CHANGE OF COLOUR IN FISH.—It is a well-known fact amongst anglers that in nearly every case the colour of fish, especially trout, is particularly adapted to the portion of the stream which they inhabit. If a living black trout be placed in a light-coloured basin filled with clear spring-water, within half-an-hour its colour will be of a perceptibly lighter tinge, while if it be placed in a similar coloured jar for some days, it will become absolutely white; but if, when in this state, it be placed in a dark-coloured or black jar, although at first it contrasts strongly with the dark ground, in the course of a quarter of an hour its colour will assimilate so completely with that of the jar, that it will be a difficult matter to distinguish it. No doubt this faculty of changing colour is furnished to enable them to escape from their numerous enemies, both within and without their native element; but whether the act is voluntary or involuntary on their part, has not yet been satisfactorily determined.

THE FIRST DESCENT INTO A VOLCANO.

POPOCATEPETL—the hill that smokes, in the Mexican language—the huge mountain clothed in eternal snows, and regarded by the idolaters of old as a god, towers up nearly 18,000 feet above the level of the sea, and in the days of the conquest of Mexico was a volcano in a state of fierce activity. It was looked upon by the natives with a strange dread, and they told the white strangers with awe that no man could attempt to ascend its slopes and yet live; but, from a feeling of vanity, or the love of adventure, the Spaniards laughed at these fears, and accordingly a party of ten of the followers of Cortés commenced the ascent, accompanied by a few Indians. But these latter, after ascending about 13,000 feet to where the last remains of stunted vegetation existed, became alarmed at the subterranean bellowings of the volcano, and returned, while the Spaniards still painfully toiled on through the rarefied atmosphere, their feet crushing over the scoriæ and black glazed volcanic sand, until they stood in the region of perpetual snow, amidst the glittering, treacherous glaciers and crevasses, with vast, slippery-pathed precipices yawning around. Still they toiled on in this wild and wondrous region. A few hours before, they were in a land of perpetual summer: here all was snow. They suffered the usual distress awarded to those who dare to ascend to these solitudes of nature; but it was not given to them to achieve the summit, for suddenly, at a higher elevation, after listening to various ominous threatenings from the interior of the volcano, they encountered so fierce a storm of smoke, cinders, and sparks, that they were driven back half suffocated to the lower portions of the mountain.

But some time after another attempt was made; and upon this occasion with a definite object. The invaders had nearly exhausted their stock of gunpowder, and Cortés organised a party to ascend to the crater of the volcano, to seek and bring down sulphur for the manufacture of this necessary of warfare. This time the party numbered but five, led by one Francisco Montano; and they experienced no very great difficulty in winning their way upwards. The region of verdure gave

place to the wild, lava-strewn slope, which was succeeded in its turn by the treacherous glaciers; and at last the gallant little band stood at the very edge of the crater, a vast depression of over a league in circumference, and 1,000 feet in depth. Flame was issuing from the hideous abysses, and the stoutest man's heart must have quailed as he peered down into the dim, mysterious cavity to where the sloping sides were crusted with bright yellow sulphur, and listened to the mutterings which warned him of the pent-up wrath and power of the mighty volcano. They knew that at any moment flame and stifling sulphureous vapour might be belched forth, but now no cowardice was shown. They had come provided with ropes and baskets, and it only remained to see who should descend. Lots were therefore drawn, and it fell to Montano, who was accordingly lowered by his followers in a basket 400 feet into the treacherous region of eternal fires. The basket swayed and the rope quivered and vibrated, but the brave cavalier sturdily held to his task, disdaining to show fear before his humble companions. The lurid light from beneath flashed upon his tanned features, and a sulphureous steam rose slowly and condensed upon the sides; but, whatever were his thoughts, the Spaniard collected as much sulphur as he could take up with him, breaking off the bright incrustations, and even dallying with his task as if in contempt of the danger, till he had leisurely filled his basket, when the signal was given and he was drawn up. The basket was emptied, and then he once more descended into the lurid crater, collected another store, and was again drawn up; but far from shrinking from his task, he descended again several times, till a sufficiency had been obtained, with which the party descended to the plain.

Perhaps, in these days of Alpine climbing and visits to eruptive Vesuvius, such a feat would excite no attention; but it should be borne in mind that it was performed at a time when the unknown was peopled always with strange terrors, and men shrank, as a rule, from explorations even of the most common character. Science had not then spread her enlightening rays, and to most men the New World was a region of mystery and wonders, which only the more restless spirits of the age dared to penetrate.

SHOWERS OF TOADS AND ICE.

In the year 1835 several letters were addressed to the French Institute on the occurrence of a shower of toads, by persons to whose characters credit might be attached. They mention that small toads or frogs were seen falling, and were caught on an umbrella, a handkerchief spread out for the purpose, and various other receptacles. Some of these little creatures, hardly the size of a small nut, presented a rudiment of tail, proving that they were very near to their period of metamorphosis. So much for the facts. The explanation of the phenomenon generally admitted by those who admit the fact itself, is that the solar evaporation carries up with it the spawn of the frogs and toads contained in the water of marshes; that this spawn, retained in the cloud formed of the condensed watery vapour, is hatched there, undergoes its changes, and is precipitated when the cloud which bears it is resolved into rain. The electricity of the clouds would facilitate and hasten the development of these animals.

M. Duparoque, the writer of one of the above-mentioned letters, attributes the phenomenon, which he has witnessed, to the action of waterspouts. According to him, one of those whirlwinds which precede storms in the great heats of summer, in crossing marshy situations at the period of the transformation of tadpoles into frogs in the fields, raises up masses of these animals with a portion of the water they abide in; and, the waterspout becoming larger, and forming a stormy cloud, will, at a later period, vomit them forth, with the lightning and water it contains. The carrying off these animals is facilitated by their leaving their subterranean retreats and coming to the surface of the water on the approach of rain.

In support of this theory, M. Arago related that when in England, Dr. Dalton told him that he had several times collected in a pluviometer, or rain-gauge, at the distance of six or seven leagues from the coast, sea-water which had been brought thither by the winds.

A very remarkable *shower of ice* is recorded to have fallen upon H.M.S. *Simoom*, in 1860, by Captain Blakiston, in a letter to General Sabine, President of the Royal Society. The captain says:—"On the 14th of January, when two days out from the Cape of Good Hope, about 300 miles S.S.E. of it, we encountered a heavy squall, with rain, at ten a.m., lasting one hour, the wind shifting suddenly from east to north (true). During the squall there were three vivid flashes of lightning, one of which was very close to the ship; and at the same time *a shower of ice fell*, which lasted about three minutes. It was not hail, but irregularly-shaped pieces of solid ice of different dimensions, up to the size of half a brick. The squall was so heavy that the topsails were obliged to be let go. There appears to have been no previous indication of this sudden squall.

"As to the size of the pieces of ice which fell, two, which were weighed after having melted considerably, were three and a half and five ounces respectively, while I had one piece given me a good quarter of an hour after the squall which would only just go into an ordinary tumbler; and one or two persons depose to having seen pieces the size

of a brick. On examining the ship's sails afterwards, they were found to be perforated in numerous places with small holes. A very thick glass cover to one of the compasses was broken. Although several persons were struck, and some knocked down on the deck, fortunately no one was seriously injured."

CURIOUS ANTICIPATION OF THE ELECTRIC TELEGRAPH.

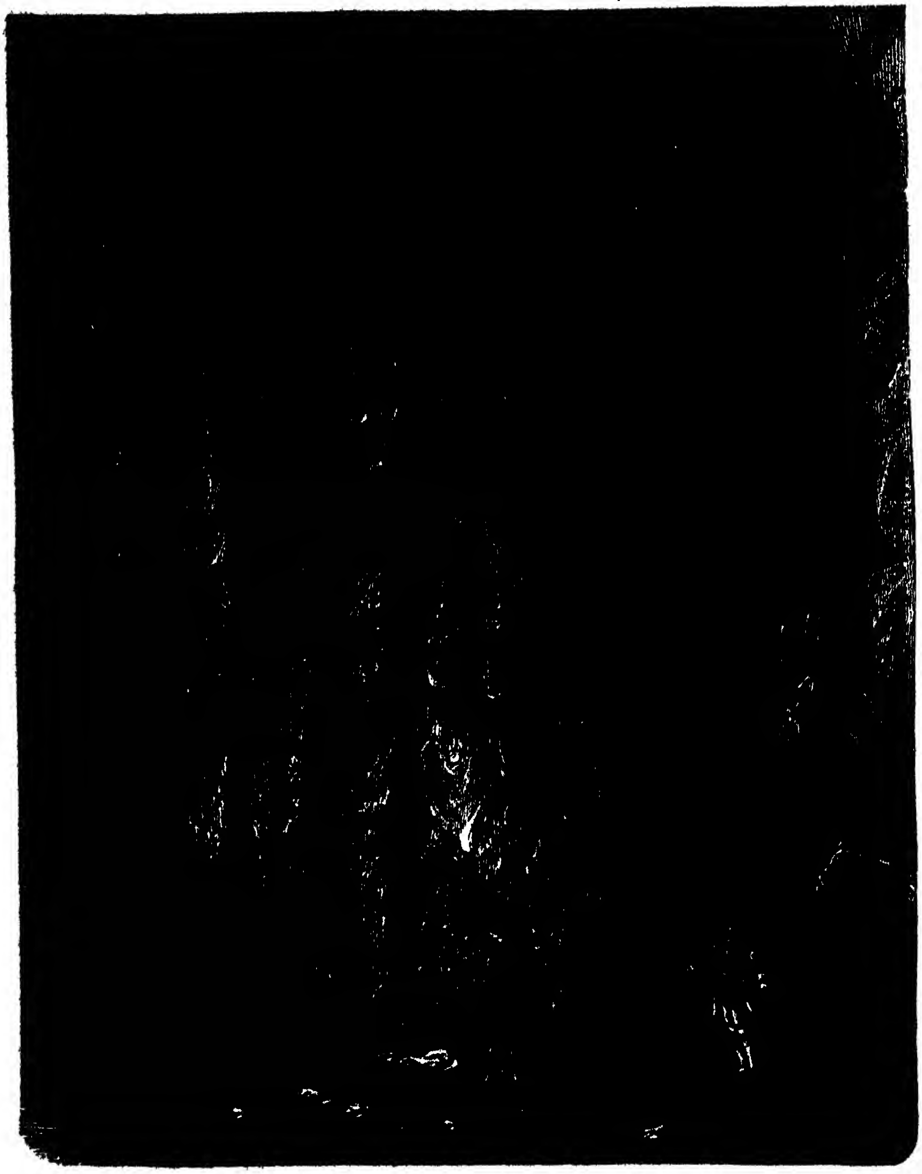
ADDISON, writing at the beginning of the last century, thus described what appeared to him to be an utterly chimerical idea, but which has since been realised with remarkable exactness in the discovery of the electric telegraph. "Strada, in one of his Prolusions, gives an account of a correspondence between two friends by the help of a certain loadstone, which had such a virtue in it that, if touched by two several needles, when one of these needles so touched began to move, the other, though at ever so great a distance, moved at the same time and in the same manner. He tells us that two friends, being each of them possessed of these needles, made a kind of dial-plate, inscribing it with twenty-four letters, in the same manner as the hours of the day are marked upon the ordinary dial-plate. They then fixed one of the needles on each of these plates in such a manner that it could move round without impediment, so as to point to any of the twenty-four letters. Upon their separating from one another into distant countries, they agreed to withdraw themselves punctually into their closets at a certain hour of the day, and to converse with one another by this their invention. Accordingly, when they were some hundred miles asunder, each of them shut himself up in his closet at the time appointed, and immediately cast his eye upon the dial-plate. If he had a mind to write anything to his friend, he directed his needle to every letter that formed the words that he had occasion for, making a little pause at the end of every word or sentence, to avoid confusion. The friend in the meanwhile saw his own sympathetic needle moving of itself to every letter which that of his correspondent pointed at.

"By this means they talked together across a whole continent, and conveyed their thoughts to one another in an instant over cities or mountains, seas or deserts. If any writer of romance," continues Addison, "had introduced a necromancer, who is generally in the train of a knight-errant, making a present to two lovers of a couple of those above-mentioned needles, the reader would not have been a little pleased to have seen them corresponding with one another, when they were guarded by spies and watches, or separated by castles and adventures. In the meanwhile, if ever this invention should be revived or put in practice, I would propose that on the lover's dial-plate there should be written, not only the twenty-four letters, but several entire words, which have always a place in passionate epistles—as flames, darts, die, language, absence, Cupid, heart, eyes, hang, drown, and the like. This would very much abridge the lover's pains in this way of writing a letter, as it would enable him to express the most useful and significant words with a single turn of the needle."

WONDERFUL CAVES.

CAVES are mentioned very frequently in Holy Writ, and they were used as habitations, or as burial-places, by the earliest Hebrews. Some caves were made or dug out by those who required them, but most of the caverns and grottoes of the limestone rocks of the Holy Land were made by nature, just as they have been formed in other parts of the world. A natural cave, of wonderful size, exists in Kentucky. Its main compartment is 150 feet high, and the floor covers an expanse of ten acres; this leads to passages and smaller caves, which have been traced for ten miles; moreover, many winding offshoots of the caverns have never been carefully examined. These caves are situated in the solid rock, and are not cracks or rents in the earth, but have been formed by the removal of so much limestone. The extent of the series of caves is so great that animals peculiar to them have lived there for centuries, and many have their eyes comparatively wasted on account of the total darkness. Our illustration shows one of the chambers of this cavern.

There are some caves in the island of Cuba formed out of a white marble rock, and they are being gradually filled up in a most remarkable manner. The caves are inland, and are situated at least 1,000 feet above the level of the sea, in the midst of dense forests. The snails, of which there are many kinds in Cuba, retire to the caves; and the water which drops from the roof of the caves on to the floor contains much carbonate of lime, a sort of chalk. When the water dries up it leaves the carbonate of lime behind, and it cements the shells together; and as this process goes on year after year, a layer some feet thick soon forms on the floor. Often lumps of the marble fall from the roof and are glued on to the shells. Multitudes of bats resort to the caves, and their dung, which is of a bright red colour, from the berries on which they feed, falls on to the layers of shell and rock, and gives them a red tint; moreover, the bats often die in the caves, and their bones are mixed up with the shells by means of the carbonate of lime. Besides this, at certain seasons of the year the soldier-crabs, which live in the shallow sea-water and on the shore during part of the year, retire to the forests and caves. Every soldier-crab



INTERIOR OF THE MAMMOTH CAVERN IN KENTUCKY.

lives in a shell of some dead whelk or top, and when he moves he carries his house on his back. These crabs start from the shore in vast numbers, and they have been traced through eight or ten miles of forest, and up to the caves in the hills. There many die or desert their shells, pulling weaker fellow-soldiers out of larger and more comfortable ones. The floor, with its moist cement, ever ready to envelop everything upon it and to harden, soon begins to rise, and after many years the cave becomes filled with the substances just described.

There are large caverns in Derbyshire, and Kirkdale Cave, in the North of England, has long been as celebrated as Kent's Cavern, near Torquay. What has rendered these last-named places celebrated is the extraordinary collection of bones and teeth found in them, all jumbled together and cemented by the same kind of carbonate of lime noticed in the Cuban caves. Now the water which dripped from the roof of the cave must have come through the limestone rock either by means of cracks, or simply by filtering. It is found that

rain-water often collects within itself the gas called fixed air, or carbonic acid gas, and when this is the case the water can dissolve small quantities of limestone. When once a crack occurs in a limestone rock opening on the surface, the rain flows down, and gradually eats away the rock; when the opening becomes large enough, a stream flows down and finds its way out, taking away more of the rock, and forming gradually a long system of passages, large caverns, and tunnels. When the supply of water fails the caves become dry, and the same thing occurs if, during the lapse of years, the river out of which the stream flowed has cut its bed deeper, or if the country has gradually become higher. When the caves were liable to be flooded from the crack leading to the open country, gravel, rolled stones, leaves, shells of snails, and decomposing drowned animals were often washed down pell-mell. When the caverns became dry, the dripping from the roof commenced, and the deposit of the cement of carbonate of lime began its office of hardening the jumble of things on the floor. Caverns exist in limestone countries for ages before they are discovered, and usually a landslip or the wear and tear of the rain and frost suddenly expose their open mouths. Many of the great animals that lived before man was created were washed down into caves, and their bones were cemented together on the floor, and thus the old wild beasts of a country have been preserved to the scientific man. In England the bones of the mammoth, rhinoceros, hippopotamus, lion, hyena, and of an immense cave bear, have been thus preserved by the thousand. It is clear that these creatures once lived on our soil, and that some of them were in existence when the first man lived in England.

There is a cave in Carmarthenshire about 280 feet above the sea level; it has the height of about 12 feet, and is from 70 to 80 feet in length. Its floor is composed of the bones of the early elephant, the rhinoceros, the reindeer, and horse, and they have all been gnawed by hyenas, whose teeth, jaws, and excrement are abundant.

In Belgium there are some wonderful caves, where men lived who did not know the use of metals, and who were armed with flints sharpened in a rude manner. In one the bones of animals, broken up by the savages for the sake of the marrow, human bones, and no less than 30,000 flint knives, scrapers, spear-heads, and chips, were found; and in another 937 horse teeth, besides the bones of the reindeer, lion, bear, and fox, were turned up, all more or less marked by the primitive weapons. Some of these animals now live in Africa and India, but most of them belonged to kinds which were probably destroyed by these early fierce men, or by the great change of climate which must have occurred since the lion, the rhinoceros, and the hippopotamus lived in Europe.

THE VEHMGERICHTE.

In a former article on the Corsican Vendetta, we gave an illustration of the evils which take their rise in social anarchy. In the Vehmgerichte we find another example of the expedients to which men resort in the absence of established laws and good government to enforce them.

The Vehmgerichte, or Fehmgerichte, as it is sometimes written, is a name given to the secret tribunals which existed in some parts of Germany, but especially in Westphalia, in the Middle Ages. The precise derivation of the title is disputed; but it is generally supposed to have proceeded from *fehm*, punishment, and *gericht*, court, meaning a court of punishment, or court of justice. Others also have conjectured that it may have been derived from the Latin *fama*, as the tribunals frequently proceeded on the basis of common report or fame.

The origin of these courts, like their name, is a matter of some doubt. They have been ascribed to the age of Charlemagne; but the first authentic record of their existence occurs about the middle of the thirteenth century. They were formed of individuals associated together for the primary purpose of punishing crimes and offences; for in the Middle Ages the law was too weak, and its administrators too corrupt, to secure the ends of justice. Bold and powerful barons could defy the authority of the sovereign, and inflict acts of tyranny and oppression upon the people, without any efficient check to their lawlessness; and to meet such cases, as well as others in which grievous wrong was perpetrated by any member of the community, the secret tribunals were instituted.

They were divided into sections having authority in different parts of the country, with a central tribunal at their head. They recognised as their president the lord of the land, who was, in Westphalia, the Archbishop of Cologne, but nominally the Emperors were also their chief officers. Each offshoot of the central tribunal was presided over by a person of position, entitled a free count; and the members of the court were divided into the two classes of *schöppen*, or *ignorant*, and the *wissende*, or *knowing—i.e.*, those who were initiated into the hidden secrets of the order. All who joined the tribunals were pledged by the most solemn oaths to secresy as to their proceedings; and, although the members of these societies are supposed at one time to have been more than 100,000 in number, it does not appear that any were ever known to break the vows they had taken.

The meetings of the tribunals were held sometimes in the open day and in a public place, but this was chiefly for the determination of civil disputes. Criminal offences, such as robbery and murder, were usually dealt with secretly, and the mode of proceeding was as follows:—If a charge

had been brought against any person, or if common rumour ascribed to him the commission of a crime, he was cited to appear before the tribunal of the district, and answer the accusation. The highest noble in the land was as liable to citation as the humblest peasant. The summons to attend was generally affixed to the door of the individual in the night, and bore the seal of the tribunal. If he refused to attend after two citations, he was considered guilty, and the members of the tribunal were empowered, and bound by their oaths, to hang him or kill him wherever they could find him. If he attended, he was heard, and allowed to clear himself, if he could, by the evidence of witnesses. If he could not do so, he was either fined or summarily executed, according to the nature of his offence. It was customary, when the punishment was inflicted, to leave a knife by the body, to show that the death was not attributable to murder, but to the sentence of the Vehmgerichte.

As the tribunal was acting under the countenance of the highest power in the land, no punishment could reach those who were obeying its decrees. The number of the members and their wide dispersion, rendered the sentence certain of execution in almost every case and the name of the Vehmgerichte was long the terror of all evildoers. In process of time, however, great abuses crept into this rude administration of justice. At a Diet held at Triers in 1512, it was declared that, "by the Westphalian tribunals many an honest man had lost his life, honour, body, and property;" and the Archbishop of Cologne, their nominal head, admitted that "by very many they were shunned and regarded as seminaries of villains." They were therefore gradually suppressed by the rising powers of the State, although never formally abolished; and when Jerome Bonaparte was King of Westphalia, a remnant of the old tribunals is said to have been discovered in action as a society for the suppression of vice.

These secret tribunals have their counterpart in many respects in what are known in some of the Western States of America as Vigilance Committees, of the action of which we still read occasionally in the newspapers.

GIGANTIC SILVER FOUNTAIN.

THE manufacture of large works in silver is not confined to countries in which that metal is most abundantly found. True it is that we read of a kitchen in South America being furnished with all sorts of kitchen utensils made of silver, and even a drinking trough for horses at an inn being entirely of that metal; but these works exhibit no specimens of taste in form, and possess all the clumsiness of rude art.

In England we have produced a work alike remarkable for its stupendous size and ornamental design, which is believed to be the largest "piece of plate" ever executed in this country. It originated as follows. The Court of Directors of the East India Company, being anxious to acknowledge the friendly deportment of the Pacha of Egypt towards our country, "in a manner worthy of the greatest political and military power of the East," had constructed a silver fountain of extraordinary magnitude and exquisite workmanship, as a present to Mohammed Ali from the company.

This truly magnificent fountain is upwards of ten feet high, and contains 10,000 ounces (about 7¾ cwt.) of silver. The base is of quadrangular form, resting on a slab of black marble. It is four feet in diameter, and terminates in fluted claws; presenting altogether the appearance of a massive and enriched pedestal. In the centre rises a sort of altar, or column, also quadrangular, whence rises a shaft containing the first and largest of the basins; within and around the edges undulates a wreath of oak-leaves and acorns, twined and banded together with excellent effect, the overhanging portions being characteristically festal. The design of the two upper basins is of corresponding character, as is also the ornamental shaft. At each of the four corners of the basement is placed a vase of elegant design, containing a bouquet of flowers in frosted silver; and falling from the scrolls of the upper table, or altar, towards these vases, are cornucopiæ filled with fruit and flowers. Their execution is very beautiful and artistically accurate.

The interior works are as follows:—From the top water is thrown by a jet worked by machinery, consisting of a force-pump, and a weighted plunger working in an air-tight vessel; and the water being thus thrown up, falls into the three successive basins in the form of the Pyramid, and returns through the centre of the lowermost basin into the reservoir, whence it is again taken up and used, on the pump being set in motion. It will play for nearly two hours, after being pumped for six or seven minutes by means of a handle inserted in one corner of the base.

The style of the ornament throughout the exterior of the fountain is that of Louis Quatorze. On the sides of the base is a convex shield bearing the following inscription in four languages:—

TO HIS HIGHNESS
MOHAMMED ALI,
PACHA OF EGYPT.
PRESENTED BY
THE EAST INDIA COMPANY.
LONDON, A.D. 1845

The other languages are Turkish, Arabic, and Latin.

The cost of this magnificent work was £7,000. It occupied somewhat more than seven months in the actual manufacture, and is in every respect a superb work of art.

ELECTRICITY AS A MOTIVE POWER.

FOR many years the employment of electricity as a means of obtaining power has been a favourite idea with electro-mechanicians. The enormous attractive force of electro-magnetism—a force apparently only limited by the size of the magnets and the power of the battery—seems at first thought to favour the supposition that it might be used practically; indeed, in 1839, Professor Jacobi illustrated the possibility of doing so, by fitting up a boat capable of accommodating ten persons with an electro-magnetic engine, and propelled it on the river Neva at the rate of four miles an hour, the battery he employed being a "Grove's," and the surface of the platinum plates very large.

It has already been explained how magnetism is produced by electricity; it will therefore be sufficient just to state that electro-magnets can be made which will lift a weight of tons. We will now briefly glance at the reasons which have hitherto prevented this powerful agent from being employed in this way. It will be found by experiment that, when a piece of iron called an armature is placed before the poles of a magnet, and at such a distance from them that it requires a force of 81 pounds to withdraw it, if the distance be doubled, it will need a force of only nine pounds to pull the armature away, and if the distance be again doubled, the force necessary is reduced to only three pounds. Suppose, for instance, the magnet is capable of attracting an armature when at a distance from it of one-eighth of an inch, with a force of three tons. Such a magnet would justly be said to possess enormous force; but now remove the armature to a distance of only one inch, and this immense attractive power is reduced to very little more than three pounds.

It is thus seen that the power of a magnet decreases very much more rapidly than the distance of the armature increases; and it is proved that what is called the "law of squares" obtains with respect to magnetic attraction—that is to say, whilst the distance increases by *doubles* the magnetic force diminishes by *squares*. The practical result of this is, that the distance through which even an exceedingly powerful magnet exerts any really useful force is *very* limited, and hence an enormous amount of power is wasted. In a steam-engine, the force of the steam upon the piston is uniform unless worked "expansively," no matter how long the "stroke." In some degree to obviate this serious objection in the use of electro-magnetism, an arrangement called a "sucking-coil" has been employed. This consists of a hollow cylinder made of a coil of insulated wire. If inside this coil a rod of soft iron be inserted a little way, when the battery is applied to the ends of the coil-wire the rod will be drawn entirely inside the coil; and if, instead of iron, a rod of magnetised steel be inserted, the power of suction is increased; and if the battery-poles be reversed, the suction is changed into propulsion. These forces are nearly uniform throughout the whole length of the coil, and so far this is an improvement over the restricted action of the magnet; but the highest force exerted by the sucking-coil falls far below that of the magnet when exerting its maximum power.

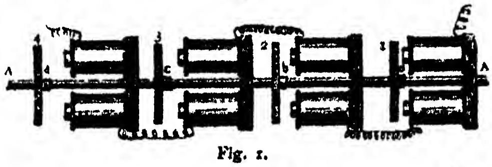


Fig. 1.

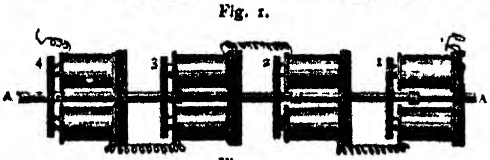


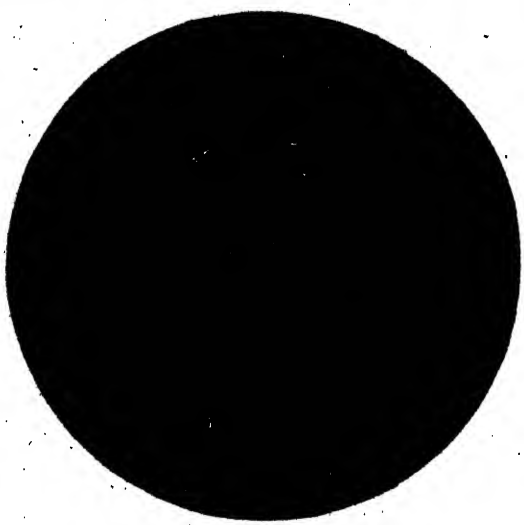
Fig. 2.

An ingenious magnetic engine has been devised, in which has been combined, to a certain extent, length of stroke with magnetic power. A number of magnets are arranged one behind the other, the poles all pointing in the same direction as shown in Fig. 1. A rod, A A, passes through the whole from end to end, upon which are as many armatures 1, 2, 3, 4, as there are magnets, the armatures not being fixed to the rod, but merely strung upon it by a hole in the centre of each. Fixed to the rod are bosses which the armatures cannot pass, and arranged at increasing distances apart; these bosses are seen at a, b, c, d. When, now, the battery current is sent through all these magnets, they attract their respective armatures, which, pressing against the bosses, push forward the rod, A A. As soon as the right-hand magnet has drawn its armature close to its poles, it is left there, and the next magnet, now continuing to draw its armature, propels the rod further forward, pushing it through armature No. 1. When armature No. 2 is pulled close to its own magnet, the next magnet keeps up the motion, and so on throughout the series. Fig. 1 shows the system at the beginning of the stroke, and Fig. 2 the same arrangement at the end of the stroke. A number of arrangements have been contrived, and a great deal of ingenuity displayed to render electricity useful as a motive power, but as yet all attempts have failed, not so much upon mechanical grounds, as on that of expense, for the amount of force obtained by the consumption of a given value of zinc is vastly less than that produced by the consumption of the same value of coal employed in the production of steam.

MINUTE PLANTS.

The microscope has revealed no objects more beautiful than the minute plants called Diatoms. They belong to the class of sea-weeds, and occupy one of the lowest places in the class because of their extremely simple structure. While most plants are made up of an immense number of little cells, each diatom is formed of only a single cell; and this so minute that it would require 2,500 of one of the most common forms (*Gomphonema violaceum*), laid end to end by their long diameters, to make one inch! while nearly eighty of one of the long and slender forms (*Pleurosigma formosum*) are needed for the same length.

They differ from all other sea-weeds in their having the power to form in their skin a shield of transparent silex. In preparing these plants for examination, the student, by means of a powerful acid or fire, generally gets rid of everything except this exquisite glassy shell. When such a prepared specimen is placed under the microscope, we see a miniature pill-box with a richly-ornamented lid and bottom united by a plain glass rim. This is the structure of all of them, whatever their shape may be; and their shapes are very variable. Some are like slender wands, others are cubes, sometimes tied at the corners like woolpacks, and others are perfect spheres. Several large groups are boat-shaped, some are oval, many are disc or pill-box shaped, a few are triangular or wedge-shaped, and others are crooked and twisted. The upper and under surfaces are marked in the most beautiful manner with regular patterns. No engraver, no engine-turner could produce such perfect designs on the largest surface; for, magnify the diatom with the highest power you can produce, and you only disclose more exquisite beauty and more perfect finish than you had observed before.



DIATOMS IN THE MICROSCOPE.

Diatoms inhabit fresh water as well as the ocean; indeed, there is scarcely a pool of water anywhere in which they cannot be found, not a roadside ditch, or water-trough, or a cistern which will not yield to the diligent searcher several forms of these microscopic plants. Their favourite fresh-water haunts are clear lakes, on the stones in mountain streams, and on the rocky faces of waterfalls; marine forms abound in shallow pools left by the retiring tide. Some are attached to rocks, or grow upon other plants, but they have very little cohesion, and the slightest disturbance sends them detached and floating through the water. Others are always free, and have the power of moving about in the water. On this account they were for some time believed to be animals, and now that they are held by all to be plants there is great difficulty in understanding how they move. A satisfactory explanation of this is much wanted. The motion is slow, the more active requiring somewhat more than three minutes to move over the space of an inch, while the slower kinds require an hour to perform the feat. Many of the large and beautiful species are free oceanic forms, swimming about in myriads in mid-ocean, and supplying food to the multitudes of simple protozoan animals, which in their turn become the prey of swimming molluscs and fish, and these again are the food of the sea-birds and the larger vertebrates of the ocean. One is filled with wonder on reflecting that all these mighty monsters of the deep depend ultimately for their food on organisms so minute as diatoms, which are individually so insignificant, but exist in nature in such abundance that their amount cannot be realised. The northern seas are frequently coloured, over patches of hundreds of square miles, of a dark deep green, by the myriads of these minute plants. Dr. Hooker says that the universal presence of this invisible vegetation throughout the South Polar Ocean is a most important feature, since there is a marked deficiency in this region of higher forms of vegetation, and were it not for them there would neither be food for aquatic animals, nor could the ocean water be purified of the poisonous carbonic acid which animal respiration and decomposition are continually imparting to it.

The indestructible nature of their shields have caused their remains to be preserved in the most remarkable way. The oceanic forms, after passing through the stomachs of various animals, as described, and being deprived of all their vegetable matter, are stored up in immense profusion in guano deposits, and add, it is believed, a special virtue to those manures when used for cereals, as they supply in a finely divided condition the silex that so many of the grasses require in their growth.

The deposits now forming in lakes and in the ocean abound in their glassy skeletons, and it is more than probable that they supplied the greater portion of the silex of which the flints of our great chalk beds are found.

Wherever a lake has been dried up, a fine whitish powder is always found, composed more or less entirely of diatoms; and as the stratified rocks are generally old sea-bottoms, they abound more or less in these organisms. Small though these plants are, they have left a greater bulk of substance to testify to their former existence than all the huge mammoths, elephants, and other mammals which were their contemporaries in some of the past ages of our globe. So small are they that every cubic inch in a bed of fourteen feet thick, at Bilin in Bohemia, contains 41,000,000,000 of them. At Egea, also in Bohemia, a bed twenty-eight feet thick has been traced for a distance of two miles. The city of Richmond, in Virginia, is said to be built upon a similar bed eighteen feet in thickness. Deposits occur in several places in Britain, though not so extensive as those mentioned. At Dolgelly, in Wales, at Mull, and other places in Scotland, and at Lough Mourne, in Ireland, considerable beds exist. The illustration shows a number of these plants as they appear in the microscope.

TRIBUNALS OF ROOKS.

ROOKS (says M. Diarmid), like men, have not all the same nice sense of justice. Some of them are honest, obliging, and industrious, others knavish, idle, and mischievous. In the spring months in particular, when they are all busy building nests or repairing old ones, certain evil-doers invade their neighbours' store of sticks to save themselves the trouble of collecting materials in a more laborious and lawful way. This to some may appear a very venial crime, but what a plank is to a carpenter a twig is to a crow, and to pilfer the one is as bad as to purloin the other. But as often as offences of this kind are detected, a complaint is made to the proper quarter, and the delinquent tried and punished by his peers. Some veteran bird acts as chief justice, and from the bustle that goes forward, the cawing of some rooks and the silence of others, it is plain that the court proceed upon system, though I cannot subscribe to the startling opinion that they examine witnesses and empanel a jury.

The presiding rook, who sits on a bough above all the others, is heard croaking last of all, and when sentence is pronounced punishment follows very promptly. Either the culprit is seized and pecked most severely, or the nest containing the ill-gotten twigs is pounced upon and demolished until not one stick is left upon another.

BLUNDERS AND ABSURDITIES IN ART.

IN looking over some collections of old pictures, it is surprising what extraordinary anachronisms, blunders, and absurdities are often discoverable.

In the gallery of the convent of Jesuits at Lisbon, there is a picture representing Adam in paradise, dressed in blue breeches with silver buckles, and Eve with a striped petticoat. In the distance appears a procession of Capuchin monks bearing the cross.

In a country church in Holland there is a painting representing the sacrifice of Isaac, in which the painter has depicted Abraham with a blunderbuss in his hand, ready to shoot his son. A similar edifice in Spain has a picture of the same incident, in which the patriarch is armed with a pistol.

At Windsor there is a painting by Antonio Verrio, in which the artist has introduced the portraits of himself, Sir Godfrey Kneller, and May, the surveyor of the works of that period, all in long periwigs, as spectators of Christ healing the sick.

A painter of Toledo, having to represent the three wise men of the East coming to worship on the nativity of Christ, depicted three Arabian or Indian kings, two of them white and one black, and all of them in the posture of kneeling. The position of the legs of each figure not being very distinct, he inadvertently painted three black feet for the negro king, and three also between the two white kings; and he did not discover his error until the picture was hung up in the cathedral.

In another picture of the Adoration of the Magi, which was in the Houghton Hall collection, the painter, Brughel, had introduced a multitude of little figures, finished off with true Dutch exactitude, but one was accoutred in boots and spurs, and another was handing in, as a present, a little model of a Dutch ship.

The same collection contained a painting of the stoning of Stephen the martyr, by Le Sœur, in which the saint was attired in the habit of a Roman Catholic priest at high mass.

A picture by Rubens, in the Luxembourg, represents the Virgin Mary in council, with two cardinals and the god Mercury assisting in her deliberations.

SENSITIVE FLAMES.

THE sensitive flames are very favourite exhibitions with the public, for the experiments by which they are shown are very simple, and yet apparently very wonderful. You are shown into a moderate-sized room, where there is a table with some short gas lamps upon it. The lamps are connected with the

gas-pipes of the house, and the burners are rather long, and have a wide opening. There are no glasses used, and the gas, when ignited, is allowed to form a tall light, just short of flaring and making a nois The experimenter then informs the company that any unusual noise, certain words containing the letters *s* or *z*, and certain musical notes, will alter the shape of the flame. When the violin is played, on the high notes being produced, the flames begin to dance, to shorten and spread out widely, and then return to their original length. If the audience talk, the flames jump up and down; and if they hiss, the light nearly goes out, and then rushes up again. It is really very difficult to persuade people that there is not a trick in the whole affair, and that some one is not stopping the rush of the gas at the sound of particular noises.

This pretty experiment was first undertaken by Mr. Barrett, in 1865. Whilst preparing for the Christmas lectures at the Royal Institution, he noticed that some very shrill sounds he was producing with a violin bow upon a thin brass plate, had a remarkable effect upon a tall and slender gas flame that happened to be burning near. At the sound of any shrill note the flame shrank down several inches, at the same time spreading out sideways into a flat flame, which gave an increased amount of light from the more perfect combustion of the gas. Many attempts were made to find out the cause. It was evident that the shape and size of the burner had something to do with the sensitive flames. Burners were formed of glass tubing drawn out and the points broken off, so as to obtain orifices of different sizes. Flames of various lengths and volumes were thus produced, but sensitiveness was only obtained with the longest and largest flames.

The shape of the burner had much effect, and the opening which resembled a V in shape was the best. The stem of a tobacco-pipe would not answer, its bore being too small; but by heating a glass tube three-eighths of an inch in diameter, and drawing it out so that the orifice was about one-sixteenth of an inch in diameter, and cutting it across, capital burners were made. These burners were connected with the gas-pipes by a length of india-rubber tubing; the gas was turned on, and a flame of fifteen inches in length was obtained. A noise of any kind—walking on the ground, shutting a book, or stamping a chair, for example—caused the flame to shrink down more or less. Its action was like that of a sensitive, nervous person uneasily starting and twitching at every little noise. Some tuning-forks were struck, and then it was proved that their proper notes had no effect upon the flames; but if they were violently struck and the shrill upper note was produced, the flames danced immediately. A large bell was sounded with a violin bow drawn across its edge, and the fine upper or harmonic notes, as they are called, influenced the flame intensely.

On running up the scale of a pianoforte, when the high notes were approached the flame became very uneasy, and at last it shortened and became very wide. This shortening of the flame is not due to the effects of puffs of air; for if, when a few yards off, the hands be brought forcibly together without touching the palms, the flame does not alter; but the slightest noise being made by finishing the clapping, the length of the flame alters immediately. It is astonishing how far-off a sound affects the flame. Whistling has a powerful result, especially if a key is used; and the effect continues as the whistler, after closing the door, whistles his way up-stairs. In one experiment the flame jumped, although the sound was being produced three stories away, and the doors were closed.

The amount of pressure of the gas has a great deal to do with the sensitive flames, and the pipes must be well supplied with gas, which will roar if allowed to escape through the burner. The pressure is so arranged that the roaring noise would commence upon the least extra amount of it. Mr. Barrett noticed that if the sensitive flame be blown upon through a fine tube, it shortens and widens; and it does so when a violin bow is drawn over the burner, or a finger is scratched down it. Moreover, if the tube connecting the burner with the gas-pipes is of india-rubber, shaking it produces a fluttering of the flame. Professor Tyndal found that when a very long flame was sensitive, and the sound used to make it shorten lasted a very little while, the shortening did not take place, but luminous tongues shot out on either side of the flame. He used a burner made of steatite, and had extra pressure of gas, and obtained a long flame of twenty-four inches. The slightest tap on an anvil reduced its height to seven inches; shaking a bunch of keys agitated the flame which moreover roared; dropping one sixpence on to another shortened the flame; and crumpling paper, or the tick of a watch, did the same. The winding up of a watch produced a tumult in, and the patter of rain agitated, the flame. All sounds will not affect the flame, but it is by the influence of the nature of sound that the sensitiveness is produced. When a large instrument produces a powerful sound, any wood on which the hand may be placed trembles or vibrates, and this trembling takes place also in the air. Sounds are produced by the tremblings in the air going down the canal of the ear, and producing a tremulous condition of the drum of the ear. Now, the gas is being forced through a hole in a long burner in a manner which just stops short of making a noise, and of producing trembling in the metal or glass in which the hole is formed. Any additional trembling acting in the surrounding air diminishes the size of the hole, and acts as if the gas were

shut off for a second. Down goes the flame, and when the trembling or vibration ceases it rises up again. Vibrations and tremblings are produced in a variety of manners, and most of them act at first on the burner and then on the flame. Other gases besides coal gas will produce the sensitive flames.

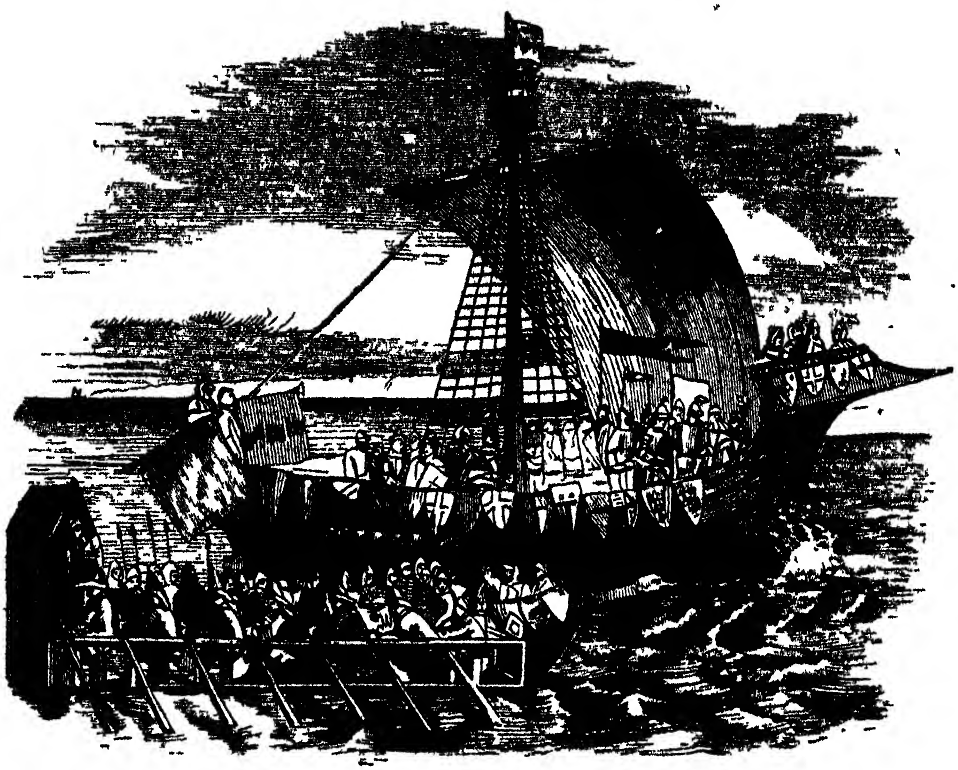
OUR ANCESTORS' SHIPS.

OUR ancestors' ships were as wonderful as our ancestors. It is difficult to understand how they could have rendered the service required of them. In Cæsar's time they were light boats, with keel and ribs of wood joined together with wicker-work, the latter being covered over with stout leather. They were capable of holding some four persons, were not decked, and had a small sail on a single mast, a paddle over the quarter for a rudder, and a set of oars. In these frail barks the ancient Britons crossed to France and to Ireland, and coasted along their own shores. During the time that the Romans held the land, the Britons do not seem to have improved upon their old-fashioned craft; but, on the other hand, the Romans found that galleys which suited the waters of the Mediterranean were not adapted to the British waters, and had to modify their ship-building upon the British model.

Speaking generally, the vessels of the Anglo-Saxons and of the Danes were only large, deep, open boats, none of them exceeding fifty tons burden; their prows and stems considerably elevated, and usually ornamented with effigies of men, birds, and beasts. To a single mast, supported by a few shrouds, a large square sail was suspended, and formed the means of propulsion when the wind was fair; but the sailors depended chiefly on oars, by means of which they also steered. The helmsman kept one hand on the steering-paddle, and held the sheet of the sail in the other; the sail was bent on a sort of yard, which was hoisted by means of halyards secured at the foot of the mast. In boats of this kind, which accommodated at no time more than sixty men, the expeditions of sea-kings were made, and voyages completed which would now-a-days be considered risky, unless made in well-formed steamers. The Danes appear sometimes to have come down with "long ships," in which wooden turrets were erected, and a half-deck laid, for greater convenience in fighting; but the majority of the sea-going ships of the period were of the kind mentioned, and were navigated by means of the stars and by local geographical knowledge, upon voyages of commercial and national importance.

King Alfred improved the British ship in order to let it cope with the Danish "æscs," or war vessels. The ships he built "were full twice as long as the others; some had sixty oars, and some had more; they were both swifter and steadier, and also higher, than the others. They were shapen neither like the Frisian nor the Danish, but so, as it seemed to him, that they would be most efficient," and they seem to have been a sort of galley. Improvements were made subsequently by other princes, and at the time of the Norman Conquest our ancestors' ships were very respectable things, quite capable of keeping the sea, and of holding their own against the ships of other nations. The Norman Conqueror's vessels, if we may judge from the Bayeux Tapestry—and there is no other contemporary guide—were inferior in build and accommodation to those of the English; but then most of them were built expressly for the invasion service, and were probably not specimens of the best Norman ship-building. They were large open boats, with high stem and stern, driven by sails and oars, had high gunwales, round which the shields of the soldiers were hung, forming an additional bulwark, and held from twenty to sixty men. The horse-boats were flatter and broader, and had low gunwales, over which the horses on arrival were made to leap on to the beach. It may be easily imagined that vessels of this cranky nature were not over safe, and though it does not appear that any disaster happened to the Norman fleet *in transitu*, a storm which blew on the night after the fleet's arrival in Britain, destroyed several hundreds of them, so that William, rather than lose all means of retreat, spent ten days in hauling up the remainder of his ships within the confines of his camp.

For many years the Normans were content with such ships as they had, but about the time of Richard Cœur de Lion (A.D. 1189), vessels of much larger size, and of various classes, began to be built. The ships of the navy, if such an expression may be used, consisted of large galleys, afterwards called galliasses, or galiones, small war-boats, and busses, which were large vessels with bluff bows and bulging sides, and were chiefly used for the conveyance of troops, stores, and merchandise. There is no authority, though some slight evidence, for saying that these vessels had more than one mast, but they were decked, and had fore-castles and after-castles, and wooden nests or tops on the masts, from which the mariners hauled the sail and the soldiers shot arrows and flung down stones in an engagement. Vissers were horse-boats, or sea-going barges. "Snakes" and "serpents" were long, swift pinnaces, used in war for "cutting out," and for despatch boats. The large galleys were double-decked, accommodating two banks of rowers, and were capable of carrying 300 men. Some of them had stone-throwing instruments fixed upon the forecastle, and some, in addition, were fitted at the prow with copper shoots for the purpose of projecting Greek fire. King Richard's own galley



SHIP OF WAR AND GALLEY, 15TH CENTURY.

was called "Trench-the-mer," because of her fleetness, and gave her name not only to a class of vessel, but also to the families of those who sailed in her. "Escomers," or foam-makers, were light, fast vessels, introduced soon after Richard's time, probably under John, who, with all his faults, may be said to have been the founder of the British navy properly so called.

In 1228 a cabin is mentioned for the first time, in a royal warrant for a ship to be sent to Gascony with the king's effects; four shillings and sixpence being paid "for making a chamber in the said ship, to place the king's things in." In 1242, when the king and queen went to Gascony, convenient cabins were ordered for their use, which were to be wainscoted.

About this time mention is made of sorneks, nascellas, and cogs, the former being apparently of the "lighter" or "billyboy" class, the latter large vessels used both for warlike and commercial purposes. Not till late in the thirteenth century does it appear that ships had two masts, and of these the fore-mast hung over the bows, its sail serving the function now discharged by a fore-staysail. Rudders were still unknown, and remained so till well on into the reign of Edward III., by which time also the art of ship-building and navigating had become greatly improved. "Ships" of this period averaged 200 tons burden, and carried a crew of sixty-five men besides soldiers. "Barges" were also of considerable size, and much used as guardships; but "cogs" appear to have been the first-class ships of the fourteenth century. The cog *Thomas*, in 1360, had a master, two constables, two carpenters, 124 sailors, and eight boys.

One sail to each mast is all that is ever mentioned, but it seems that when it was desired to "mowe saile nere," "bonnets," "wynwes" (wind-wooers), or what are now called studding-sails, were fastened to the great sail or "trief;" and sometimes as many as three "bonnets" were fastened to a sail.

As to wages paid by our ancestors to shipmen, it seems that in 1360 a master, a carpenter, a constable, and a clerk, were paid at the rate of sixpence a day; seamen received threepence, and boys a penny. Sometimes, it appears, the king gave the master of the vessel "sixteen shillings to buy a robe."

Ships and shipping remained in pretty much the same state after the reign of Edward, until Henry VII. came to the throne. With Henry, who built the *Great Harry*, began the modern system of ship-building, and our ancestors' ships went out of date.

Wonders of the Sky.

THE AFTERGLOW IN EGYPT.—I do not remember (says the author of "Eastern Life") to have read of one great atmospheric beauty in Egypt—the afterglow, as we used to call it. I watched this nightly for ten weeks on the Nile, and often in the desert, and was continually more impressed with the peculiarity as well as the beauty of this appearance. That the sunset in Egypt is gorgeous everybody knows; but I, for one, was not aware that there is a renewal of beauty some time after the sun has departed and left all grey. Among the Alps, the flame-coloured peaks become grey and ghastly as the last sunbeam leaves them. But here everything begins to brighten again in twenty minutes; the hills are again purple or golden, the sands orange, the palms verdant, the moonlight on the waters a pale green ripple on a lilac surface, and this afterglow continues for ten minutes, when it slowly fades away.

EXTRAORDINARY LIGHT.—In one of the *Gentleman's Magazines* of 1756, what must have been a brilliant example of Aurora Borealis was thus described :—"On the 2nd of January, 1756, at four in the afternoon, at Tuam, in Ireland, an unusual light, far above the brightest day, struck all the beholders with amazement. It then faded away by invisible degrees; but at seven, from west to east, a sun of streamers appeared across the sky, undulating like the waters of a rippling stream. A general feeling of alarm was excited by this singular phenomenon. The streamers gradually became discoloured, and flashed away to the north, attended by a shock which all felt, but which did no damage."

THE TABLE-CLOTH AT THE CAPE.—The Table Mountain at the Cape of Good Hope rises like a broad and flat wall to the height of 3,500 feet above the sea, and derives its name from being perfectly flat on the top. Here a remarkable circumstance connected with the south-east wind presents itself. The mist which gathers on the mountain gradually spreads over its surface and falls over the perpendicular sides like a table-cloth. The wind then pours down upon Cape Town with a terrific roar, while the Table Mountain remains covered with its misty table-cloth, from which fragments seem to be torn and whirled about in mid-air like rags. The whole of this phenomenon generally occurs between noon and five o'clock, when the storm clears away, and the table-cloth begins to be folded up. A serene night generally follows.

REMARKABLE LUNAR PHENOMENON.—The journal of Captain Parry's voyage in the Arctic regions in 1821 contains the record of a very rare phenomenon, under date of December 20th. The officer of the watch, at seven on that day, observed that the moon, in rising, assumed the appearance of two, on hearing of which Captain Parry himself went on deck and verified the statement. The moon was about half a degree high at the time, and a second crescent appeared a little below it. Mr. Scallon, the gunner, stated that the reflection had at first appeared as distinct as the moon itself, and it was nearly so when the captain arrived on deck. Afterwards it faded away, having continued visible from first to last for about five minutes.

A WONDER OF PRIDE.

NEAR the village of Edgware, on a plain now verdant and "smiling in scorn," there once stood a palace of such gorgeous magnificence that it seemed suited rather to a prince than to a subject. The most eminent architects had been employed in its construction; artists came from Italy to adorn its walls, and costly marbles formed the pillars. Such was the abode of James Brydges, Duke of Chandos, a nobleman whose unbounded magnificence, lavish expenditure, and overweening vanity obtained for him the designation of "princely."

It was not to architectural grandeur alone that the Duke of Chandos confined his views; his style of living corresponded with the magnificence of his mansion, and fell little short of the state of a sovereign prince. He dined in public; and, when he repaired to chapel, he was attended by a military guard. The Divine service he had performed with all the aid that could be derived from vocal and instrumental music. To this end he retained some of the most celebrated performers of the day, and engaged the greatest masters to compose the anthems. Handel, who acted as *maestro di capella*, produced, while at this palace, his famous oratorio of "Esther;" and the eminent musician Pepusch, also employed by the duke, composed there some of his finest works. But how fleeting is all earthly magnificence! The fortune of the "grand duke" experienced injury from speculation. His lavish disbursements added to his embarrassments, and at length the South Sea Bubble came to decrease still further his means of enjoyment. He continued, however, to reside at "The Canons"—though, it would appear, with diminished splendour—till his death in 1744. When the duke died, this magnificent mansion was, after fruitless attempts to dispose of it entire, pulled down, and the materials sold by auction.—*Burke's "Anecdotes of the Aristocracy."*

THE MAELSTROM.

THE Maelstrom is a whirlpool off the coast of Norway, between the islands of Loffoden and Moskoe; and because of its propinquity to the latter is sometimes called the Moskoestrom. Many stories have been written about it which border on the confines of the marvellous rather than of the truth. Poets have been busy with the fact of its existence,

and ancient legends have told with wonderful exactness how heroes have dived into the vortex in order to show their zeal for their lady loves, and how virtue and courage have come unharmed out of the great depths, while wickedness and vice have so weighted men that they have been overwhelmed in the whirlpool. Old-world thought led to the belief that at the spot where the Maelstrom was, there was a great hole in the earth, through which the water poured, and that those things or men which were engulfed in the pool were either passed through the earth to its other side, or were returned broken and drowned to the place whence they came by a return coil in the mysterious water spiral. Water jötuns, or water giants, were of course supposed to preside over the whirlpool, and to arrange according to the dictates of their own fancy who should be saved and who destroyed. One hero whom they permitted to re-visit the upper world was speechless ever after, unable, by sign or word, to give an account of the marvellous things he had seen. Many a ship was sucked down into the watery grave, many a fair cargo lost, and yet the water dæmon was not satisfied; no amount of sacrifices seemed to propitiate the hungry ocean gnome.

Modern science, with its secret-searching light, has scared the water-demon from his lair, and has given an explanation of the causes of the whirlpool, quite incompatible with the existence of such a contrivance as the Maelstrom was represented to be. When the configuration of the land between Droutheim and the North Cape is seen, it will not surprise any one that the rush of the tide, cooped up as it is in its passage through the Loffoden Islands, should result in a wash of the whirlpool kind. The strong tide flowing down from the northern sea is caught in a rocky angle, which causes a kink in the stream, twisting it round with violence enough to cause the Maelstrom, the most dangerous whirlpool in the world. The whirlpool is thus described by an American writer:—"I had occasion, some years since, to navigate a ship from the North Cape to Droutheim, nearly all the way between the islands, or rocks, and the main. On inquiring of my Norwegian pilot about the practicability of running near the whirlpool, he told me that with a good breeze it could be approached near enough for examination without danger, and I at once determined to satisfy myself. We began to near it about ten a.m. in the month of September, with a fine leading wind N.W. Two good seamen were placed at the helm, the mate on the quarter-deck, all hands at their stations for working the ship, and the pilot standing on the bowsprit between the night-heads. I went on the main topsail-yard with a good glass. I had been seated but a few minutes when my ship entered the dish of the whirlpool. The velocity of the water altered her course three points towards the centre, although she was going eight knots through the water. This alarmed me extremely for a moment. I thought that destruction was inevitable. The vessel, however, answered her helm sweetly, and we ran along the edge, the waves foaming round us in every form while she was dancing gaily over them. The sensations I experienced are difficult to describe. Imagine an immense circle running round, of a diameter of a mile and a half, the velocity increasing as it approximated towards the centre, and gradually changing its dark blue colour to white—foaming, tumbling, rushing, to its vortex; very much concave, as much so as the water in a funnel when half run out; the noise too, hissing, roaring, dashing—all pressing on the mind at once, presented the most awful, grand, solemn sight I ever experienced. We were near it about eighteen minutes, and in sight of it two hours."

Vessels caught in the inner swirl, and having no means of escape, must inevitably be upset and broken by the violence of the waves, or dashed to pieces on the rocks which underlie the sea. Whales are sometimes caught and destroyed in the whirl, and it is related that a bear, having put off from one island on a predatory expedition after some sheep on another, was sucked in, and that his roaring and bellowing were for a long time heard at Moskoe, until the waters of the whirlpool quenched his spirit and his voice.

Extinct Reptiles.

THE ICHTHYOSAURUS.—This gigantic creature no longer exists, and is only known to us by the bones which are often found in such abundance as to form perfect skeletons. The general shape of the reptile can be gleaned from the study of the skeletons of it which have been found in chalk quarries, and in the dark blue stone from which lias cement is made. The bones have become stone, but their shape has been preserved. The word ichthyosaurus means fish-lizard, and it is a remarkable fossil, because it combined in itself the characters of other animals. Thus it had the general form of the kind of whale which is called the grampus, it had the snout of a porpoise, the teeth of a crocodile, the head of a lizard, the back of a fish, the paddles of a turtle, and it was as savage and destructive as all these creatures put together.

As its name implies, the ichthyosaurus was a fish with many peculiar structures in it, which were usually only found in reptiles. It lived in the sea and attained the length of thirty feet, much of which belongs to the head. The eyes were most extraordinary, for their sockets, or the holes in the skull into which they fitted, were a foot or more across, and there were some curious bony plates in the form of a circle on the white of the eye. Some-

thing like this is seen in eagles and in other birds which move through the air at a great rate in pursuit of prey; and the use of the apparatus is to enable the bird to see a thing a long way off, and not to lose sight of it by approaching very rapidly. When the ichthyosaurus saw its prey deep in the sea, its peculiarly shaped eyes did not lose sight of the required object, although the rush through hundreds of feet of water might have taken but a few seconds.

SKELETON OF THE PLESIOSAURUS.

The tail of the ichthyosaurus was a huge fin, and on each side of the body were two paddles, formed of thick skin covering a sort of hand, in which were a hundred small bones. The snout and jaws were long, sharp, and furnished with sharp teeth. These were two and a half inches in length, like lancets in shape, and there were at least a hundred of them in each jaw. The jaws were very strong, and could open very widely; moreover, there was an arrangement by which the creature could take in air like a whale, and go down into the depth of the sea. It preyed on fish and the numerous reptiles that lived in those old oceans, and its principal companions were the other two reptiles about to be noticed.

SKELETON OF THE PTERODACTYL.

THE PLESIOSAURUS.—This extinct reptile was less like a fish than the ichthyosaurus, and was the oddest-looking animal ever created. Like the other reptile, it combined the peculiar forms of several creatures, and lived by the sea shore or up rivers. The plesiosaurus was not a land animal, however, but it could not dive nor swim quickly in the sea water. It had the head of a lizard, the long neck of a snake, the body and paddles of a turtle, and a tail. The reptile had the appearance of a great turtle, with a long snake nearly pulled through its body. The head was small, and the teeth like those of the crocodiles and ichthyosaurians; the neck was used like that of a swan, and the plump body was kept on the surface of the sea by the large side paddles, which were made very much on the same plan as those of the whale-like reptile just described. It was a snapping reptile, which plunged its head down into the water, picking up small fish, and which could catch any bird or reptile flying over the water. Perhaps in its turn it was eaten by the ichthyosaurus, or by some of the great crocodiles whose bones are found in the same strata.

THE PTERODACTYLS.—At the time when the ichthyosaurus was the tyrant of the sea, and the plesiosaurus raised its long neck above the water to seek its prey, there were wonderful dragon-like lizards that lived on the land and flew over vast tracts of country. The pterodactyl had a head and neck like those of a bird, as far as the general shape was concerned, and its wings resembled those of bats, whilst the body and tail might have been taken from any young land animal. The jaws were not beaked like a bird, but had long lancet-shaped teeth, often sixty in number, which could kill creatures much larger than their owners. The eye was large, and the head was very movable; so that with great wings, occasionally measuring eighteen feet across, these reptilian birds were just as terrible in the air as the plesiosaurus and ichthyosaurus were in the sea. The wings of the pterodactyl were not feathered, and they were furnished with claws attached to a hand, whose little finger was enormously lengthened to form the support on which the wing, or rather membrane, was hung. Hence the name pterodactyl, or wing-finger. Some of the skeletons of these creatures were not bigger than those of a snipe; others must have belonged to pterodactyls larger than the biggest condor. A small flying lizard still lives, but it is not very much like the flying lizard with the wing-finger.

THE WETTERHORN, FROM ROSENLAUI.

whose summit is a vast pyramid, being the highest and most stupendous mass. The distant hills of Central France are on the right hand, and there extends far away on the left a diminishing series of gigantic mountain chains, dark at their bases, but covered above with the never-melting snow, which is faintly tinged by the bright hue of the rising sun. The Rhine and the Danube arise far away in the east, but the Rhone mainly comes from the lake below; and this is fed by a river running through a dark valley, whose narrow gorge is seen on the left, crushed in between two enormous and precipitous mountains. There, all is still dark in the valleys; but the sun has tinted the tops of the hills since daybreak, and in the evening, long after the darkness has commenced in the lowlands, the snowy peaks will be illuminated by the last rays of the setting sun. Rugged and jagged as the tops of many of the mountains appear, they are nevertheless covered with snow, and between them are the vast seas of ice called glaciers. From the spot where all this can be seen, the whole looks like a great rocky projection starting upwards from the plain and lake. The clearness of the atmosphere renders the distances very deceptive; for the great pile of Mont Blanc, which appears very close, is really sixty miles off. Its summit is 15,781 feet above the level of the sea, but it must be remembered that the plain out of which it rises is at least 3,500 feet higher than the sea. Some other mountains are nearly as high as Mont Blanc, such as Monte Rosa, 15,585 feet, and the Jungfrau, which is 13,729 feet in height. The snow is everlasting on such mountains, and it rarely disappears, even in the hottest summers, on any of them which are more than 8,500 feet high; so that this height is called the snow-line. Below this, many plants are found in little valleys, or on the rocks where there is some mould, and still lower down the forests of pine and fir trees commence. When the height of the mountains which are always covered with snow is considered, it is at first sight rather strange that their summits, being thousands of feet nearer the sun than the plains, should be so cold. They derive much heat from the sun, but they do not get it from any surrounding thing as well; and when the sun goes down their heat passes off into space. The Alpine valleys are often very hot, and even at very considerable heights ice may be touched with one hand and flowers gathered with the other. The clouds which constantly cover up the tops of the mountains deposit moisture upon them; this is turned to snow and ice, and as much of it as melts during the day passes down the streams and torrents into the small rivers in the deep valleys, and finally falls into the great rivers. When a closer view of the Alps is obtained, and the great valleys, narrow gorges, awful precipices, and magnificent waterfalls are examined, they command as much admiration as the wonderful rocky hills that tower above them all. The questions arise at once in the mind: How did all this come to pass? how long have these mountains stood, being worn away as they are and have been, by every stream, and ground-scratched and split by the glaciers? and of what are they composed?

Geologists prove that many of the mountains which rise to the height of 10,000 feet are principally composed of shells, and that they are not mounds of earth, but vast layers of old sea bottoms, on which the inhabitants of the shells formerly lived, tilted up at right angles—just as we may lift a book by one end from a table, and stand it up on the other end. They show that thousands of feet of many great mountains, like the Righi, are masses of rolled pebbles formed by the action of running water on rocks which have been quite worn away; and that vast precipices, extending for miles, have been the sides of glaciers or of torrents that have cut their way through a fine, dark, slaty rock, which must have been deposited at the greatest depths of the ocean. There are no volcanoes in the Alps, and they were not pushed up out of the earth by volcanic agency. The shells and the rolled pebbles tell part of the story of the upheaval of the Alps: their deposits were once in deep water; but the whole of Europe arose from the sea inch by inch, and became dry land. Then the deep force which did this continued to act in the region of the Alps, which attained a great elevation; and then granite and other rocks, which are molten when in the depths of the earth, were forced upwards. They pierced the crust, and formed the greatest mountains of the Alps, and they threw off and uptilted the old shelly hills on their sides. The Alps look as if they were from everlasting; but they are much younger than our Welsh hills, and they are of the same age as the Andes and the Himalayas of India.

of

Magnetic Clock and Watch.—When the Grand Duke of Tuscany, in 1669, visited the Royal Society at Arundel House, he was shown "a clock whose movements are derived from the vicinity of a loadstone; and it is so adjusted as to discover the distance of countries at sea by the longitude." The analogy between this clock and the electrical clock of the present day is not a little remarkable. The Journal-book of the society for the above year contains many allusions to "Hooke's magnetic watch, going slower or faster according to the greater or less distance of the loadstone, and so moving regularly in every posture."

The Pyramids of Egypt as Sun-dials.—Sir Gardner Wilkinson conjectures that these stu-

pendous monuments were built for astronomical purposes. "The form of the exterior might lead to many useful calculations. They stand directly due north and south; and while the direction of the faces to the east and west might serve to fix the return of a certain period of the year, the shadow cast by the sun, or the time of its coinciding with their slope, might be observed for a similar purpose."

HOROLOGY has enabled us to discover that when the wind passes at one mile per hour it is scarcely perceptible; while at the rate of 100 miles per hour it acquires sufficient force to tear up trees, and destroy the produce of the earth; and without the aid of a seconds clock it would have been scarcely possible to ascertain that a cannon-ball flies at the rate of 600 feet in a second.

A TRUE WATCH.—It has been said that "no man ever made a true circle, or a straight line, except by chance;" and the same may be said of any machine which measured time exactly; indeed, positive accuracy can never be attained until an unchangeable material is discovered, of which the works may be constructed.

SMALL FEET OF CHINESE WOMEN.

THE diminutive feet of the women of China was long regarded as a national peculiarity, asserted to be of natural growth, and has thus been a wonder in the books of travellers; but by our less restricted intercourse with China the secret has been let out. There were certain small-footed ladies at Hong-Kong who gained a very fair livelihood by exhibiting their feet to sea-captains, and other curious Europeans, at a dollar a head, and the evidence satisfied a superficial examination and belief. But it appears that in the missionary schools may be seen numbers of little girls whose feet are in the various stages of torture, as narrated by a visitor who had the opportunity of witnessing what he has well described. On an appointed day the children were all seated in a row, and their feet, which had undergone a preparatory washing, were unbound by their mothers. The first was a child of two years old. Her penance had but just commenced. When the bandage of blue cotton was taken off it was seen that the great toe had been left untouched, but the other four had been forced down under the ball of the foot, and closely bound in that position. The child, therefore, walked upon the knuckle-joints of her four toes. The toes were red and inflamed, and the ligature caused evident pain. In the next three children, of ages advancing at small intervals, the preparation was only to the same extent; it was confined to the four toes. Gradually, however, these four toes, according to the continual pressure, lost their articulation and identity as limbs, and became amalgamated with the sole of the foot. In the eldest of the four the redness and inflammation had entirely disappeared; the foot was cool and painless, and appeared as though the four toes had been cut off by a knife. The foot was somewhat of the shape of a trowel.

In the fifth girl was seen the commencement of the second operation—a torture under which sickly children frequently die. The sole of the foot was now curved into the shape of a bow; the great toe and the heel being brought together as near as possible. This is done very gradually. The bandage is never slackened; month by month it is drawn tighter. The foot inflames and swells, but the mother perseveres. As the bones and tendons accommodate themselves to the position constrained by the bandage, so it is drawn tighter. At last the ball of the natural foot fits into the hollow of the sole, and the root of the great toe is brought into contact with the heel. The foot is a shapeless lump. The instep is where the ankle was, and all that is left to go into the slipper and to tread the ground is the ball of the great toe and the heel.

This is the small foot of the Chinese woman; a bit of toe and a bit of heel, with a mark like a cicatrice left after a huge cut, running up between them. Two of the girls seen by the narrator were and their feet were hot and inflamed, but in the eldest the operation was complete. She had attained to the position of a small-footed woman, and her feet were quite cool, had no corns, and were not tender to the touch. One of the mothers solved the mystery. Sometimes, it seems, when a woman is expected to have to do hard work, her toe and heel are not drawn together so as to produce the true "small foot." To disguise this imperfection upon her marriage day she has recourse to art. A piece of cork, shaped like an inverted sugarloaf, is strapped on to her foot, and the small part goes into her slipper, and passes for her foot.

THE SALINAS OF IVIZA.

THE remarkable salt-fields of Iviza, whose existence is known to very few unconnected with Spain, occupy a tract of level ground near the south-west corner of the island. They are several acres in extent, and are divided by low walls into many square compartments, each about 100 yards square. As they are situated near the coast, the first impression of the visitor is that the sea-water is admitted, as upon the coast of Hampshire, and evaporated by the sun. This, however, is not the case. The salt appears to be an exudation from the ground, and the process of obtaining it is as follows:—The ground is cleaned and flattened previous to the November rainfalls, during which the rain-water is allowed to fill the compartments to the depth of about a foot. When the rains cease, the sun warms the water, and there then appears at the bottom a formation of bubbles, which increase in

violence from day to day, until, in about a week, white crystals gradually form, and spread branch like over the ground. This crystalline structure, which is, in fact, the salt, increases in extent and thickness, until a mass of a uniform thickness of about two inches remains over the entire ground. When the water has all evaporated, the salt remains behind beautifully white. This is then broken up with spades and sorted; the lower portion, which is discoloured by contact with the soil, is thrown into heaps, and the finer and whiter crystals carefully selected and stored under cover.

This salt is intensely pungent and powerful in action, and will keep for years in an ordinary dry room without melting.

This wonderful process of saline formation goes on year after year, and forms a large source of revenue to the Spanish government, to whom the property belongs.

The fact that there are no noxious reptiles in Iviza is attributed to the saline character of the soil, which is observable in a greater or less degree throughout the island.

AN ATTEMPT TO STEAL THE CROWN OF ENGLAND.

In the reign of Charles II. a desperate attempt was made to carry off the crown and other regalia of England from the Tower of London, which was all but successful. The chief perpetrator of the deed was a man named Colonel Blood, who had previously been engaged in other crimes of an equally daring nature. He had once, with several accomplices, waylaid the Duke of Ormond, Lord Lieutenant of Ireland, and was about to hang him at Tyburn Gate, and it was only with great difficulty that the Duke escaped.

The mode in which Blood set to work to gain possession of the crown was as follows:—The regalia were then, as now, shown to the public in the Tower, and he visited it disguised as a clergyman, with a lady on his arm. While the keeper —a man named Edwards—was showing them his treasures, the lady pretended to be taken suddenly ill, and the keeper's wife, being called to her assistance, conducted her to her private apartments, and treated her with great kindness. A few days afterwards Blood called with a present for Mrs. Edwards, in acknowledgment of this civility, and so ingratiated himself into the favour of herself and her husband that he became on constant visiting terms.

The keeper had a daughter for whom his new friend the clergyman professed great admiration, and he offered to find her a suitable spouse in the person of his nephew, who, he said, was a young man of good property. A meeting was agreed upon between the young couple, and Blood was to bring his fictitious nephew to the Tower for that purpose. One morning, accordingly, he presented himself at the jewel-house with a young man and two others, who, he said, were friends of his who were just about to start for the country, but were anxious to see the crown jewels before they departed.

They proceeded immediately to the room in which the regalia were kept, the keeper meanwhile having sent his wife and daughter notice to be presently in readiness to receive their expected guests. One of Blood's party, on some pretence or other, was left at the door to give an alarm to the rest if occasion required. As soon as the keeper with his three visitors had entered the jewel-room, he was seized and gagged, while his life was threatened if he made any disturbance. Notwithstanding this, he made desperate efforts to create an alarm, but was beaten about the head with a mallet until he was compelled to silence.

Blood now secured the crown and thrust it under his cloak; one of his companions took the orb, and another the sceptre, which he was proceeding to file in two for convenience of carrying it away, when some relatives of the Edwardses unexpectedly arrived at the jewel-house. The signal was given by the accomplice at the door, and the whole party now hastened out with their booty. As they departed, the keeper renewed his efforts to attract attention, and soon brought some of his family to his assistance.

The alarm was immediately spread, and several persons started in pursuit of the thieves, who, however, were so far ahead that they reached the drawbridge before any one attempted to stop them. A warder now tried to arrest Blood, but he was knocked down by a pistol-shot, and the thieves pursued their course in safety to Tower Hill. Here some of the keeper's party overtook them, and one, Captain Beckman, grappled with Blood, and escaping his fire, tore the crown from his clutches. Several of the jewels rolled out of it upon the ground; the principal gem—a ruby valued at ten thousand pounds, and which was given to Edward the Black Prince by the King of Castile—was not found until several days had elapsed, when it was picked up by an old woman who was sweeping a crossing.

Blood's companions were likewise arrested and their booty seized, and the whole party were lodged in the Tower. The King, when he heard of the crime, gave orders that Blood, and the man who had pocketed the orb, should be brought before him at Whitehall; but he was so impressed by Blood's boldness and effrontery, and with his plausible address, that he not only pardoned him, but gave him an allowance for his subsistence, and until the end of his days this unworthy miscreant enjoyed the royal favour.

THE MAUSOLEUM, OR TOMB OF KING MAUSOLUS.

KING MAUSOLUS, the oldest of the three sons of Hecatomnus, the wealthiest of the Carian dynasty, died B.C. 353, when his widow, Artemisia, mixed the ashes of her husband with wine, which she drank, and erected to his memory at Halicarnassus (now Budrum) a superb tomb, which was esteemed one of the Seven Wonders of the World, and, by its artistic celebrity, has given the name of *Mausoleum* to tombs and sepulchres of stately character.

The tomb of Mausolus was designed by the architects Satyros and Pythios; the names of the sculptors were the celebrated Scopas of Paras, and Bryaxis, Timotheus, Lochares, and also Pythios; and we know the part of the structure which each of the sculptors embellished with his work. Artemisia died before the monument was completed; when the artists are said to have finished the work for their own honour and the glory of art. Strabo in the first century, Pausanias in the second century, Gregory of Nazianzen in the fourth, Constantine Porphyrogenitus in the tenth, and Eudocia in the eleventh centuries, respectively speak of the Mausoleum in terms which imply that it was still existing during these periods; while Fontanus, the historian of the siege of Rhodes, states that a German knight, named Henry Schelegellott, constructed the citadel at Budrum out of the Mausoleum, and decorated the walls with its marbles and bas-reliefs.

FRAGMENTS OF THE TOMB OF MAUSOLUS, FROM THE BRITISH MUSEUM.

To the indefatigable exertions of Mr. Newton, now the keeper of the Greek and Roman antiquities at the British Museum, we owe the recovery of the best part of the remains of this famous tomb. They consist chiefly of a large portion of the frieze (one of the slabs preserves its original sharpness of

sculpture in a remarkable manner); several of the lions which stood in the intercolumniations; the head of a lion, treated in the best style of art, and for which Mr. Newton paid a dollar! part of a colossal equestrian statue finely modelled, probably one of the corner decorations; the statue of Mausolus himself, of which, however, Professor Westmacott doubts the genuineness; the companion statue, that of the goddess who stood in the quadriagea with Mausolus, acting as his charioteer; portions of the horses; a head, in very fine condition, with part of the bronze bit, &c., and a fragment of the chariot itself; the head of the statue, which is believed to have represented Artemisia, and torsoes, heads, and pieces of several other statues, as well as portions of the architectural ornaments.

The existence of these marbles had long been known, when, in 1846, they were, through the influence of Sir Stratford Canning, presented by the Turks to the British nation, and are now in the British Museum, which thus possesses fragments of two of the Seven Wonders of the World—the Mausoleum, and a fragment of the carving of one of the Pyramids of Egypt. That the bas-reliefs now in the Museum were inserted in the Budrum walls by the Knights of Rhodes is proved by the escutcheons, Latin sentences, and date, 1510, as well as by an inscription on a shield borne by one of the figures.

The entire tomb was raised on a platform, a parallelogram, 469 feet on the outside, in the centre of the finest street of the city which Mausolus himself delighted in—Halicarnassus, now the cheerful little town of Budrum. It comprised a small chamber in the basement for the remains of Mausolus; a *podium*, or temple, upwards of fifty feet high, in which the admirers of the deceased might assemble to pay homage to his memory; a *pteron*, or colonnade, above this, consisting of thirty-six graceful Ionic columns, thirty-seven and a half feet high; a pyramid of steps and pedestal, with a base 108 feet long and eighty-six wide, resting upon these columns; and on the top of all a colossal group, representing the apotheosis of Mausolus—Mausolus carried to heaven by his favourite goddess in a chariot drawn by four horses abreast. At the corners of the basement, and level with the ground, were placed colossal groups of sculpture; above, between the columns, deities and heroes reclined, while lions and other animals guarded the *cella*. The material was Parian marble, parts being coloured, some pure red, the others pure blue. When Anaxagoras saw this costly work he exclaimed, "How much money is here changed into stone!"

From the description of this monument by Pliny has been modelled the upper part of the steeple of St. George's Church, Bloomsbury, London, the surmounting figure, instead of Phaëton, being that of George I. in Roman armour.

In our illustration we give a view of some of the fragments grouped together of this celebrated tomb, which are now to be seen in the British Museum.

ARTIFICIAL PRODUCTION OF AN AURORA BOREALIS.

Sir John Ross, the well-known Arctic voyager, laid before a meeting of the British Association at Belfast an interesting account of some experiments he had made to test his own theory respecting the phenomena of the Aurora Borealis. He believed that these phenomena were "occasioned by the action of the sun, when below the pole, on surrounding masses of coloured ice, by its rays being reflected from the points of incidence to clouds above the pole which were before invisible;" and he thought they might be artificially produced. "To accomplish this," he observed, "I placed a powerful lamp to represent the sun, having a lens, at the focal distance of which I placed a rectified terrestrial globe, on which bruised glass of the various colours we had seen in Baffin's Bay was placed, to represent the coloured icebergs of that locality, while the space between Greenland and Spitzbergen was left blank, to represent the sea. To represent the clouds above the pole which were to receive the refracted rays, I applied a hot iron to a sponge, and by giving the globe a regular diurnal motion I produced the phenomena vulgarly called 'the merry dancers,' and every other appearance, exactly as seen in the natural sky, while it disappeared as the globe turned. In corroboration of my theory," continued Sir John, "I have to remark that during my last voyage to the Arctic regions (1850-51) we never, among the numerous icebergs, saw any that were coloured, but all were a yellowish white, and during the following winter the aurora was exactly the same colour; and when that part of my globe was covered with glass of that colour, the phenomena produced in my experiment were the same as the Aurora Australis, in the Antarctic regions, where no coloured icebergs were ever seen."

FIRE-PROOF CLOTHING.

In Savoy, Corsica, Cornwall, and Scotland, is to be found a fibrous mineral, which is woven into a fire-proof cloth, whence its name *Asbestos*, unconsumable. It occurs also in the United States of America, where it is sometimes used as a wick for an oil-lamp. The ancients were acquainted with the art of weaving this curious cloth, and they made asbestos garments and gloves to imitate the human skin.

Nearly two centuries since, the fire-proof property of asbestos was publicly proved in England. Dr.

Plot records that, at a meeting of the Royal Society in the year 1676, a merchant, lately come from China, exhibited a handkerchief made of *salamander's wool*, or asbestos, and, to try whether it were genuine or no, it was put into a strong charcoal fire, in which not being injured, it was taken out, oiled, and put in again. The oil being burnt off, the handkerchief was taken out, and had lost only two drams five grains of its weight, but was more brittle than ordinary; when cold, however, it nearly recovered its tenacity and weight. The merchant stated that he had received the handkerchief from a Tartar, who told him that among the Tartars this sort of cloth was sold at £80 sterling per China ell, which is less than our ell. He added that the Chinese greatly used this cloth in burning the bodies (to preserve the ashes) of great persons; and that in Tartary, asbestos is "affirmed to be made of the root of a tree."

Sir Hans Sloane possessed in his museum a purse made of asbestos, which he purchased of Dr. Franklin, who notes in one of his letters:—"Sir Hans Sloane heard of it, came to see me, and invited me to his house in Bloomsbury Square; showed me all his curiosities, and persuaded me to add that (the asbestos purse) to the number, for which he paid me handsomely."

In our own times, the Chevalier Aldini, of Milan, has applied asbestos as a protection against fire. The incombustible pieces of dress which Aldini used for the head, feet, and hands, were made of asbestos, or mountain flax, as it is also sometimes called. The head-dress was a cap enveloping the head down to the neck, having perforations for the eyes, nose, and mouth. The gloves were made of double asbestos cloth, to enable a fireman to handle burning or red-hot bodies. Over these was worn a dress of iron wire gauze. To prove the safety of this apparatus to the fireman, Aldini showed that a finger first enveloped in asbestos, and then in a double case of wire gauze, might be held for a long time in the flame of a spirit-lamp or candle before the heat became inconvenient. A fireman wearing a double asbestos glove, and the palm protected by a piece of asbestos cloth, seized with impunity a large piece of red-hot iron, and carried it 150 feet, ignited straw with it, and brought it back to the furnace. On other occasions the fireman handled blazing wood and burning substances, and walked during five minutes upon an iron grating placed over flaming fagots.

A rocky substance has been found in Australia, which, after being exposed to the atmosphere, becomes changed into a material resembling the finest staple of wool, and soft and pliant as any silk. In sinking a well, a correspondent of the *Orange Guardian* has in one day got as much of this mineral as would make a suit of clothes. Should asbestos ever come into general use, it will, in some measure, from its incombustible nature, supersede the evils of crinoline. Besides this great advantage, it will also set aside the expense and use of soap and water; for all a lady will have to do will be to put her articles of wearing apparel into a glowing fire, and when they have become as white as a snow-flake, she may resume them at her pleasure.

Wonderful Insects.

INSECTS IN ROCKS.

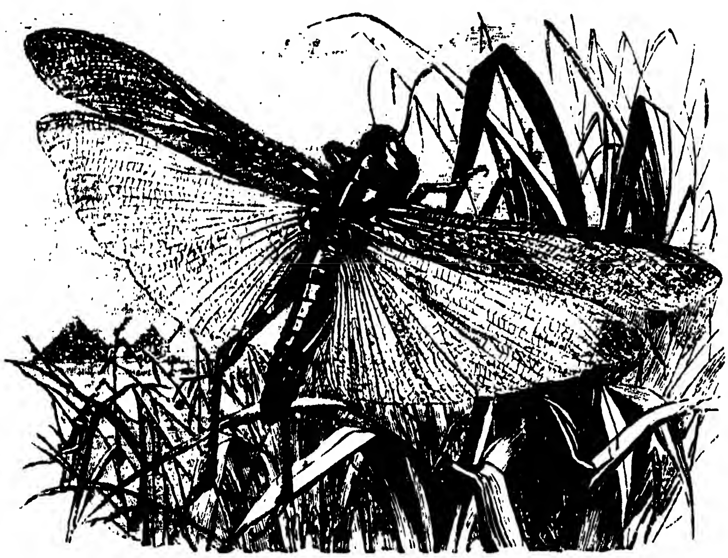
There is a very thick layer of earth in the centre of France which is composed of countless numbers of the old burrows of caddis-worms. This indusial stone, as it is called, contains so much lime that the layer of earth has become a rock. If a clear shallow brook with a sandy bottom be examined on a summer evening, many small things with heads, eyes, and jaws will be seen struggling about and dragging a kind of sandy, tubular coat which covers them. The caddis-worms, and many others, collect small stones, grains of sand, and pieces of hard clay, and glue them together in the form of a short tube by means of some sticky stuff which exudes from the skin. The worms live inside these curious coats, and when they die the sandy tube remains. This is called an indusium, and the indusial limestone of France is made up of these remains of ancient caddis-worms.

In one of the geological formations of England, which is called the lias, there are layers of earth almost entirely formed by the wing-cases of beetles. There is lime in the earth, which has turned the original matter of the wing-cases into a sort of hard chalk, and the layers are called insect limestones. It is at first difficult to form an idea how such a vast number of beetles could be got together to form thick layers of their wing-cases. These cases are the parts which last the longest after death, and doubtless all the rest of the insects was destroyed. Geologists prove that the layers containing the insect remains were deposited as silt at the bottom of a large lake or quiet river; so it must be supposed that during many years the beetles frequented the neighbourhood of the lake, and died on its surface.

LOCUSTS.

These great, grasshopper-looking insects have been sad scourges to mankind, and the Egyptian plague of them has happened more than once since that early date. Africa, especially that part near to Egypt, has been at different times infested by myriads of these creatures, which have consumed nearly every green thing. The effects of the havoc committed by them may be estimated by the famine they occasioned. St. Augustine mentions a plague of this kind in Africa which destroyed no less than

800,000 men in the kingdom of Massinissa alone, and many more in the territories bordering upon the sea. It is also related that in the year 591 great hosts of locusts migrated from Africa into Italy, and after grievously ravaging the country were cast into the sea, and there arose a pestilence from their stench which carried off nearly a million of men and beasts. In the territory of Venice, in 1478, more than 30,000 persons are said to have perished in a famine occasioned by the devastations of the locusts, and instances of their dreadful numbers have been recorded in France, Spain, and Germany. In different parts of Russia, Hungary, Poland, Arabia, India, and other countries, the locusts have come at regular intervals. In the accounts of the invasions of locusts, the statements which appear most marvellous relate to the prodigious mass of matter which encumbers the sea wherever they are blown into it, and the pestilence arising from its putrefaction. Their dead bodies are said to have been in some places heaped one upon the other to the depth of four feet in Russia, Poland, and Lithuania; and when, in Southern Africa, they were driven into the sea by a northwest wind, they formed, says Barrow, a bank three or four feet high along the shore. When we consider that forests are stripped of their foliage, and the earth of its green garment for thousands of square miles, it may well be supposed that the volume of animal matter produced may equal that of herds of large animals accidentally falling into the sea. Nevertheless, unless Augustine had been a saint, the death of so many men would have been doubted.



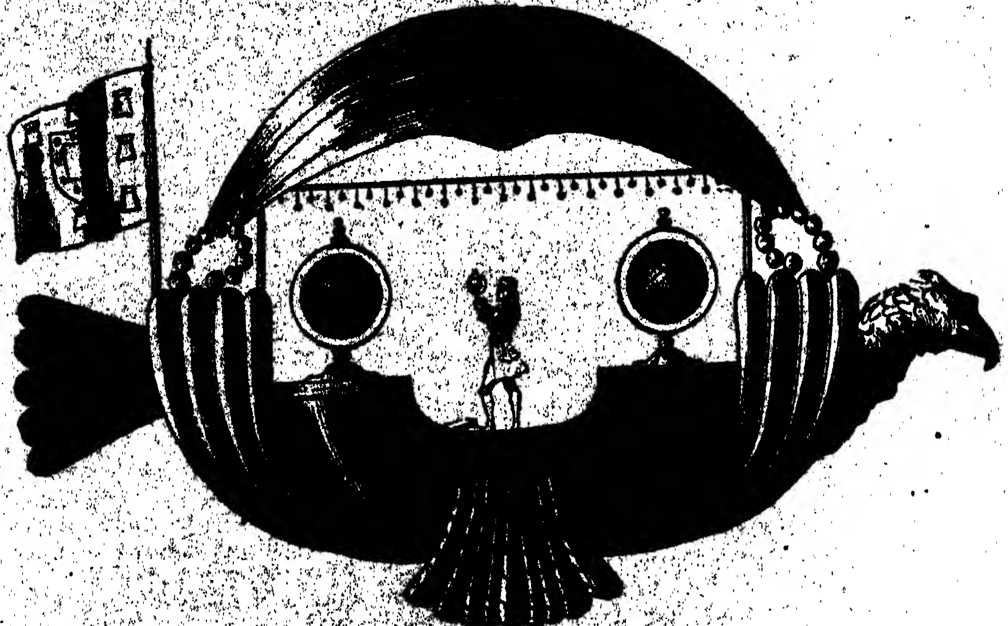
MIGRATORY LOCUST.

ANIMALCULES.

If some hay is placed in a glass of pure rain-water, and allowed to soak for a few days in a sunny place, and if it be then removed, the water will be found, under a powerful microscope, to contain many very small moving things, which are called infusoria, from their being produced after infusing the hay. The eggs which were on the hay bred there myriads of small things, which often have a very beautiful coat of transparent flint or silica. If the water is kept clean, and is not allowed to decompose or smell, generation after generation of the infusoria live, die, and fall to the bottom of the glass. They form a very delicate film there, and minute portions of it, when examined under a high magnifying power, show the siliceous skeletons or shells very distinctly. Now many strata in the earth are formed entirely of the remains of infusoria, and a very familiar example is the Tripoli-powder, from the polishing slate of Bilin, in Bohemia. A single grain of Tripoli-powder contains no fewer than 187,000,000 of the transparent flinty skeletons of dead animalcules; yet the layers of earth which are made up of them at Bilin extend for miles. In the harbour of Wisenar, in the Baltic, they increase and multiply at a great rate, for 17,496 cubic feet of mud are formed every year there, and every grain of it contains 100,000,000 of the beautiful siliceous remains of the infusoria. In the island of Barbadoes there is a thick mass of the most beautiful flinty sea animalcules, and they are in such numbers that it must be supposed the dead minute things were constantly falling in showers from the sea to the bottom.

FLYING-MACHINES.

The first attempt at flying in this country occurred early in the sixteenth century, when an Italian adventurer visited our island. He was very favourably received by James IV. of Scotland, and having promised to gratify the Court with the exhibition of a plan which would enable any person to visit the most distant regions in a few hours, he had an apparatus made consisting of huge wings, to be propelled by cords. Thus equipped, the adventurer leaped from the wall of Stirling Castle, and, as might have been expected, speedily



FLYING-MACHINE, 1709.

reached the ground. His reasoning on this unlucky result is worthy of being preserved: "My wings," said he, "were composed of various feathers; among them were the feathers of a dunghill fowl, and they, by a certain sympathy, were attracted to the dunghill on which I fell; whereas, had my wings been composed of the feathers of eagles alone, as I proposed, the same sympathy would have attracted my machine to the higher regions of the air." This sophistry is at least ingenious.

The [illegible] Post newspaper of 20th—22nd December, 1709, contains a curious description of a "Flying Ship" said to have been invented by a Brazilian priest, of which we give an illustration, copied from an old cut. The ship, which at both ends was [illegible], had sails which turned as they were directed; [illegible] wings to keep the ship upright, and a [illegible] to govern it. In the body, at each end, was a pair of bellows, to be blown when there was no wind; two globes of metal, to cover two loadstones to draw the ship after them; the body was of thin iron plates covered with straw mats for ten or twelve men besides the constructor. Above the body was a network of iron wire, on which were fastened large amber beads, "which, by a secret operation, would help to keep the ship aloft; also by the sun's heat the mats that lined the ship would be drawn towards the amber beads. The artist, by the help of the celestial globe, a sea-map, and compass, was to take the height of the sun, thereby to find out the spot of land over which they were on the globe of the earth." There were pulleys and ropes to hoist or furl the sails; but we do not find that the design was at all practicable.

Dr. Darwin proposed to use wings similar to those of a bird, and to these motion was to be given by a gigantic power worked by high-pressure steam. The details of his plan were not fully drawn out; but a few years afterwards Sir George Cayley attempted to show, by reference to mathematical data, that a flying chariot might readily be constructed so as to rise in the air. We believe this ingenious inventor expended a large sum of money in endeavouring to mature his plans, but they ended in failure. The rocket of Colonel Congreve, and its application to the conveyance of passengers by Mr. Perkins, come next in the list; and though a steam conveyance rocket is a very ingenious invention, yet there are few persons

who would like to demonstrate its practical utility

In the spring of 1843, Mr. Henson, a mechanician, proposed the use of light frames, to be covered with silk or linen, and placed in such a positio as to form with the body of the aërial vehicle an angle similar to that of a bird when in the ac of "skimming" through the air. The first imp lse was to be given to the machine by means of an inclined plane, down which it was to slide. V ith an apparatus thus constructed, there was no q es- tion but that a velocity might be attained cap ble of supporting the framework with the neces ry covering for a short period of time; but a v ry few seconds must ensure its descent to the ea h, despite the operation of the steam-propellers. Mr. Henson properly went to nature for the posit n of the bird's wing, but he lost sight of the import nt fact that in animal mechanics the prime mo er possesses an organisation altogether different fr m that of elastic vapour giving motion to brass a d iron. In the same way, it was proposed by anotl er inventor to move propelling wings by human power, when one of our most eminent anatomists demonstrated that the muscular power of a man is not one-eighth that of a bird. A pigeon has been known to fly a hundred and ninety miles in five hours and a half—a speed that no human being can ever attain; whilst the velocity that must be imparted to the propellers for the mere support of such a machine, under the most favourable circumstances, must be vastly greater than was ever yet imparted to any machine constructed by the ingenuity of man. There is another fact of which we ought not to lose sight in estimating the practical utility of the aërial carriage. Its framework, or wings, on which everything must necessarily depend, were 150 feet long by thirty feet wide, offe ing an area of 4,500 feet; and when we look the mechanical resistance offered by the air to that extent, it is hardly possible to conceive a plane so knit together by human workmanship as to preserve its stability. Garnerin descended in a parachute with perfect safety, and so did Mr. Hampton, at Cheltenham, by the tension of a woven fabric; but as soon as a framed parachute was opposed to the resistance of the air, with an increased velocity, which would be the case in the present instance, the machine was broken into shreds.

To the spectator, the most striking part of Mr. Henson's machine was the immense web, which, in the most important respects, was to fulfil the office of wings. The framework had neither joints nor the peculiar motion of wings, but was perfectly stiff from end to end. One of its long sides went foremost, and was a little raised; to the middle of the other was jointed the tail, fifty feet in length, below which was a rudder. A small vertical web placed across the wings at their middle point, ser to check lateral oscillation. The several pa like the main frame, combined strength with treme lightness: for this purpose, upright posts standards were used, to the tops and bottom which various points in the horizontal frame wei connected with metallic braces. These parts wei all shaped so as to pass through the air with th least possible resistance. The car, and a very ligl and powerful steam-engine, were suspended froi the middle of the wings, and were close to its und surface. This steam-engine set in motion two se of vanes of twenty feet diameter, and six vane each placed at the hinder edge of the wings, and near to each other as the joint of the tail permitte The engine was of nearly twenty-horse power. Tl condenser was composed of a number of small tube into which the steam was admitted, and which we exposed to the current of air produced by the rap flight of the machine. The plan was found perfect efficient, and it dispensed with the necessity f carrying water, either to supply the place of th which was discharged as steam when it had pei formed its work, as in high-pressure engines, c to condense it that it might be returned to th boiler. Though the engine was of the power c twenty horses, it was worked with twenty gallons c water, and its entire weight, with its boiler fillec was not more than 600 pounds. A large mode of Mr. Henson's aërial machine was constructe and patented, but its principle was altogether defec tive, and one of his critics observed that, to enabl Mr. Henson's machine to go up, he must fir have succeeded in putting a horse-power engine with its boiler, water, condenser, and fuel for a lon voyage, into a weight of ten pounds! We nee scarcely add that no ascent was ever made.

Wonders of Mechanism

LACE MECHANISM.—Mr. Babbage, on a visit to Nottingham, sat for two hours looking at a particular machine, by which some surprising results were accomplished, and gave the reason for his narrow inspection of the machine, which was that, though effectual for its purpose, it had been put together by a man whose contrivances showed that he was no mechanic at all, but merely felt his way from stage to stage.

THE STEAM-ENGINE.—The late Mr. Kennedy, of Ardwick House, who was on intimate terms of personal friendship with Watt, on one of his last visits to Soho, asked him if he had discovered anything new in the steam-engine. "No," he replied; "I am devoting the remainder of my life to perfecting its details, and to ascertaining whether in any respect I am wrong."

THE CALCULATING MACHINE in its simplest

form, effects the operation of addition by causing a figured wheel to advance a given number of unit spaces, by moving through the same number of spaces a wheel with which it is in gear. The process of multiplication is merely that of successive additions, and subtraction and division are the inverse processes of the former.

THE MAGNETO-ELECTRIC LIGHT, based on Faraday's discovery in 1831, and produced by steam-power, causing the rotation of sets of magnets, is stated to be the most brilliant and continuous artificial light yet known. It has been successfully employed in certain lighthouses since 1858.

THE STEREOSCOPE.—Till its discovery, naturalists could hardly believe the possibility of *a single image resulting from double vision*, and Gall and Spurzheim endeavoured to explain it by the supposition that one eye only was active at a time, the other merely admitting light, and that Nature had given us two merely to provide against the accidental loss of one.

PRINTING.—By the abstraction of two screws Gutenberg's formes of type fell to pieces; and within comparatively few years, similar screws have been substituted for "quoins" or wedges in locking up formes—a revival of Gutenberg's screw method of 400 years since.

THE THAMES TUNNEL is spoken of as a great novelty. There was, however, a tunnel under the Euphrates at Babylon, and another under the wide mouth of the harbour at Marseilles.

THE EAGRE, OR BORE.

THE singular tidal phenomenon known as the Eagre, or Bore, has been observed on the estuaries of several rivers, and is thus accounted for :—

If a river subject to very high tides gradually expand towards the sea into a broad mouth, the tidal wave passing up the river, meeting with banks gradually approaching one another, is compelled to flow in a channel continually diminishing in sectional area; the consequence is that the water accumulates in the estuary more rapidly than it can flow up the river, and so becomes piled, as it were, upon itself in the form of a huge wave, or wall of water, several feet in height, which, travelling up the river with great rapidity, meets the descending stream with such violence as in some cases to be accompanied with a noise like thunder. This is the phenomenon of the *bore*, which occurs regularly at high water of spring-tides in the Bristol Channel and in the Solway Firth, and at unusually high tides in the rivers Trent and Wye, and in some other rivers of Great Britain. The most celebrated *bores* are those of the Tsin-tang in China, and of the Brahmaputra, Ganges, Hooghly, and Indus, in India.

But before we proceed to give an account of any one particular bore, it may be well to say a few words in explanation of what is called the tidal wave.

Every one knows that the phenomenon of the tides is due to the attracting influence of the moon upon the water in the ocean—sometimes in conjunction with that of the sun, and sometimes opposed to it.

If the earth and the moon were relatively fixed, and there were no other disturbing influence, the water of the ocean would be heaped up in one huge wave under the moon, and at that point there would be perpetual high water; but, owing to the motions of the earth and moon, this wave, instead of remaining over one spot on the earth, is, as it were, left behind, and in a negative way tends to follow the apparent motions of the moon. The coasts, being brought alternately to the crest and trough of this wave, experience what we call high and low water.

There is just such another wave produced by the sun, which wave endeavours to follow the apparent motions of the sun, just as the lunar wave tries to follow those of the moon. These two waves are sometimes superposed the one on the other, their crests being together, producing spring-tides; and sometimes the crest of the solar wave is in the trough of the lunar, which it in part neutralises, giving us neap-tides: in other words, spring-tides are the result of the sum of these two waves, and neap-tides of their difference.

Owing to differences in the configuration of the land and in that of the sea-bottom, some places have greater range of tide and stronger tidal currents than others, and it is when these latter are great that the tidal wave most favours the phenomenon of the bore.

From this, it may be a matter of surprise that among the many rivers having great range of tide, we hear of so few that are visited by the bore; but it must be remembered that the configuration of the coast-line of the estuary is a more important element in its production than either the depth or speed of the tidal wave.

This phenomenon occurs regularly at the times of new and full moon on the river Seine, where it is known as *le flôt*. Here it appears as a wall of water, six or seven feet in height, which extends the whole width of the river, and sweeps upwards with great velocity. It takes place when the tide begins to flow, bringing high-water with it to places along its course. The calm, clear river is immediately turned by it into a surging, muddy sea, and it is a considerable time before it assumes its wonted tranquillity.

Though of fortnightly occurrence, it is a source of unfailing attraction to the people of Caudebec and the neighbouring villages, who invariably gather

in crowds along the banks to await its approach whenever it is expected.

The bore of the river Tsin-tang presents a still grander example of this curious phenomenon. It attains its greatest magnitude opposite the city of Hang-chow-foo. Loud shouting from the craft in the river announces the appearance of the flood, which seems like a glistening white cable stretched athwart the bay as far down as the eye can see. Its noise, compared to that of thunder, speedily drowns that of the boatmen; and, as it approaches with prodigious velocity, it assumes the appearance of an advancing cataract, five miles across and about thirty feet high, which threatens to submerge everything afloat; but they all vault, as it were, to the summit with perfect safety. This grand and exciting season is but of a moment's duration; the wave passes up the river in an instant, but from this point with gradually diminishing force, volume, and velocity, disappearing entirely a few miles above the city. From ebb to flood tide the change is almost instantaneous; a slight flood continues after the passage of the wave, but it soon begins to ebb.

This sudden change from low to high water appears to be a general characteristic of the bore; indeed, it seems as if all the water of the flood-tide waited to accumulate itself into one heap, and then rolled in, in as many minutes as it usually takes hours.

The effect of a bore is always greatest at the time of the equinoxes, but the direction of the wind, by either accelerating or retarding the force of the tidal wave, can very much add to or take away from its effect. For the phenomenon to be seen in its maximum grandeur, it is necessary for the flow of the river to be at its greatest speed, with an equinoctial gale blowing up-stream at the time of an unusually high spring-tide.

THE PITT DIAMOND.

THE great diamonds of the world are few in number, and nearly all possess a very remarkable history. We have previously related the story of the De Sancy diamond, which is, perhaps, the most curious of all; but we will now tell the tale of a gem which is still more important, as regards size and value.

Towards the close of the seventeenth century, a gentleman named Thomas Pitt, grandfather of the great Earl of Chatham, was appointed to the governorship of Fort St. George, Madras. The palmy days when large fortunes were constantly made by Englishmen in the East had not yet arrived, and the wealth and power of England in the Indies were comparatively insignificant. But Governor Pitt was one of those shrewd men who can always find the opportunity of amassing riches, and he entered into commerce with some of the native merchants on his own account. Among other traders with whom he trafficked was a diamond-dealer named Jourcund, who possessed one of the finest stones ever found in the mines of Golconda. He offered this to the governor for sale, but the price asked—about £100,000—was too enormous for his means as well as his inclination. He not only doubted the high value of the jewel, but entertained, as he stated, a reluctance to trust anything like the sum in one venture.

By degrees, Jourcund came down in his price, and, after much haggling on either side, Governor Pitt at length secured the prize for a little over £20,000 sterling. He returned to Europe shortly after, and found that in all respects the diamond was of the very highest quality and worth. He was offered £80,000 for it, but refused this sum, and spent £5,000 in having it cut as a brilliant. Its weight before cutting was 400 carats, but it was reduced in the process to 136½. The fragments detached in the cutting were sold for £8,000. When so prepared, the jewel was the most beautiful that had been seen in Europe.

A purchaser was at length found for the diamond in the Duke of Orleans, Regent of France during the minority of Louis XIV., it being bought as an ornament for the French crown. £130,000 was the sum given for the treasure, and it became known as the "Regency diamond," from the authority by whom it had been acquired.

When the story of its purchase and re-sale at so high a profit was known, scandalous rumours became current as to the means by which Governor Pitt had become its owner. He was accused of extorting it from Jourcund by threats for a sum greatly beneath its value, and his character became blackened with infamy. To clear himself and his descendants from so great a disgrace, he left behind him a paper narrating at full the circumstances attending its original purchase, appealing to credible witnesses who had been with him at Fort St. George, in testimony of its truth. But the calumny died out. The great fame of the Governor's descendants, the Earl of Chatham and that other William Pitt, the rival of Fox, almost obliterated his own memory, and the paper does not appear to have been publicly used until the year 1825, when it was published as a curiosity in the *Gentleman's Magazine.*

The Pitt or Regency diamond continued in the possession of Louis XIV. and the succeeding monarchs, by whom it was worn on state occasions. After the Revolution, it was still preserved among the state jewels, and the first Napoleon, on his accession to power, used it as an ornament in the hilt of his sword. The sword was found, with other personal effects of the Emperor, on the field of Waterloo, by the Prussians after the battle, and was presented to the King of Prussia, in whose possession it has since remained.

THE BAROMETZ, OR TARTARIAN

AMONG the strange stories to be found in the narratives of the early travellers, few are more strange than that of the vegetable lamb of Tartary. This story, as believed by the reading public, and even by the naturalists of two centuries ago, is so marvellous, and so obviously absurd, that the greatest wonder is that it ever could have been thought to be true, even by the most credulous in a dark age.

It was believed that in an elevated and uncultivated salt-plain of great extent, west of the river Volga, there was to be found a wonderful creature, half animal and half plant, to which the natives gave the name of Barometz, meaning little lamb. Struys informs us that the Tartars and Muscovites esteem it very much, and the greater part preserve it with great care in their dwellings, where he had seen many of them. To obtain it the Tartars sow in the ground a seed like that of a melon, from which in due time rises the strange plant, having the figure of a lamb, with the feet, hoofs, ears, and the whole head, except the horns, of that animal, distinctly formed. It grows on a stalk about three feet in height, being, according to one version, rooted to the ground by its four feet, while another account raises the whole lamb, feet and all, from the ground on a single stem, on which it is able to turn, and also to bow itself downwards to the herbs on which it feeds. It lives as long as there is grass and herbage around it, but when it has consumed all within its reach it dies and withers away. Its skin is covered with a very white down, as fine as silk, and is greatly prized by the Tartars, who pull it off, and wear it as a cover for the head. Inside, it is composed of flesh and bones, and when wounded it gives out a liquid resembling blood. Wolves are said to be the only animals that will eat it, and they are very fond of it.

SPECIMENS OF THE BAROMETZ.

Specimens of this remarkable production were looked upon as the rarest treasures in the collections of the curious in days gone by. Two different specimens have been described in the "Philosophical Transactions," and a third has its portrait given in an engraving in Mr. Darwin's "Flower Garden," and its history told in the florid verse of that work. These various figures have been introduced by the artist into the accompanying illustration, which not only gives the old fable, but its modern interpretation as well.

The "lamb" is a natural production, greatly helped in the development of the particulars in which it most resembles that creature by the ingenuity of the natives. The body is a portion of the creeping stem of a tribe of ferns, which generally grow as erect as trees. This stem is densely covered with beautiful jointed silky hairs of a rich golden colour. On the surface next the ground a few roots are given off, while the leaves—or fronds, as they are called in ferns—spring from the upper surface. The fronds are as much as twelve or

fourteen feet high, and have a long bare stalk before the leaf is spread out. The Tartar takes a suitable portion of this creeping stem for a body, deprives it of the roots, and of all the leaf stalks except four, which are intended to be the legs, two short ones for the ears, and a stump for the tail, and then, turning it upside-down, trims the stem, and so produces this marvel of the early explorers. The fern (known to botanists by the name of *Cibotium Barometz*) is a native of Eastern Asia; it has been introduced into our conservatories, where it flourishes, producing, after a few years' growth, good specimens of the "lamb."

The silky hairs of this fern form a favourite remedy among the Chinese for checking the flow of blood by applying them to a wound, in the same way as felt or cobwebs are used by some people in this country. The more fibrous and elastic hairs of several species of the same group, natives of the Sandwich Islands, are largely exported from these islands to California and Australia for stuffing cushions, and similar purposes.

GIGANTIC BIRDS' EGGS.

WITH the eggs of the ostrich we are tolerably familiar, from their shells being often preserved, mounted as drinking-cups and sugar-vases. The moa's egg is a much greater rarity. In 1865 one of these eggs was brought to England for sale from New Zealand, where it was alleged to have been discovered under these circumstances:—Whilst some labourers were working upon a site to build upon, in Waizakic district, a pick struck upon a cave. On opening it, it was found to contain the skeleton of a Maori in a crouching position, with both hands on a gigantic egg, and in such a manner as if death came upon the unfortunate native while in the act of partaking of its contents. Although the shell was slightly broken, the large proportions of the egg yet remained perfect. It measured about nine inches in length, and seven inches in diameter.

It may be interesting to recall a few facts on the subject of other gigantic birds' eggs. In 1854, M. Geoffroy de St. Hilaire exhibited to the French Academy some eggs of the epiornis, a bird which formerly lived in Madagascar. The larger of these was 12.1 inches long, and 11.1 inches wide. The smaller one was slightly less than this. The Museum d'Histoire Naturelle, at Paris, also contains two eggs, both of which are larger than that offered for sale as above.

Mr. Strickland, the naturalist, in some "Notices of the Dodo and its kindred," published in the "Annals of Natural History" for 1849, says that in the previous year a M. Demarele, a highly respectable French merchant at Bourbon, saw at Port Leven, Madagascar, an enormous egg which held "thirteen wine quart bottles of fluid." Mr. Strickland appears to doubt this, but there seems no reason to do so. Allowing a pint and a half to each of the so-called quarts, the egg would hold 19½ pints. Now the larger egg exhibited by St. Hilaire held 17⅝ pints, as he himself proved. The difference is not so very great.

Captain Cook found, on an island near the north-east coast of New Holland, a nest "of a most enormous size. It was built with sticks upon the ground, and was no less than six-and-twenty feet in circumference, and two feet eight inches high" (Kerr's "Collection of Voyages and Travels," xiii. 318). Captain Flinders found two similar nests on the south coasts of New Holland, in King George's Bay.

AVALANCHES.

WE have spoken in a previous number of one of the most remarkable phenomena to be seen among the loftiest ranges of mountains—namely, glaciers. The chief perils which those who visit such scenes have to encounter are from avalanches. These are immense falls of snow or ice suddenly detached from the ridges and high slopes of mountains. They may be divided into three kinds, those of snow, névé, and ice. Snow, when it first falls, is not compact; and when, during the winter, it accumulates in large quantities on the ledges and in the crevices of the mountains, it requires but a small force—a strong wind or its own weight—to set it in motion. The movement makes itself felt for some distance, and the snow, gathering in quantity as it increases in velocity, rushes down in one large mass into the valley beneath. Snow avalanches fall mostly in winter, and are very destructive to property, sometimes filling up a valley and overwhelming villages in a few minutes. They are called in German *Staub-lawinen* (dust avalanches), from the fineness of the particles of snow, and how appropriate is the term may be learnt from the account of an avalanche that fell on the village of Saas, in Switzerland, on the 3rd of April, 1849. In its path was a pine wood, but its progress was not arrested by the trees, the snow gliding through the branches like dust or smoke.

A species of snow avalanche is often to be met with on the higher parts of a glacier, where freshly-fallen snow rests on the steep slopes of névé or ice. They are dangerous to mountain travelling, for, as has been said, a trifling cause, such as a small stone falling, or even, as it is popularly believed, the sound of a human voice, is sufficient to set them in motion. They come down with a sound like the prolonged dwelling with the voice on the word "hush," and happy is the man whom they overtake if he is only partially buried, and not carried down by them into the *Bergschrund*, or deep crevasse, that they generally overhang. In Dr. Hamel's attempt to ascend Mont Blanc, three of

and
in trees
tapped, it is
sons. Forty-three
ave been counted in a

AN AVALANCHE.

the party lost their lives from this kind of avalanche.

When snow is allowed to get somewhat consolidated, it becomes, by the same process by which glaciers are formed, partial ice or névé. This is slightly melted by the heat of the sun in the spring and early part of the summer, and the action of the water that percolates through the mass causes it to slide down the incline it rests upon. Like a huge snow-ball, getting bigger and bigger as it rolls along, it makes its way down into the valley in a semi-compact condition, destroying everything that comes in its way, uprooting and snapping asunder large trees, damming up the courses of rivers, and making a pine forest appear like a field of stubble. Avalanches of this kind rarely descend to the lower valleys, but they are particularly destructive to villages in the higher valleys. In 1720 one overwhelmed the village of Obergestelen in the Bernese Oberland, killing eighty-four persons and 400 head of cattle. The village of Ruäras, in the Grisons, has more than once been partially destroyed from the same cause. To travellers in the spring they are very dangerous; and it is not uncommon to find in many of the Alpine passes a memorial cross marking the spot where a life has been lost through the fall of one of these spring avalanches.

Ice avalanches are very frequent in the summer. Seen at a distance, they are disappointing; and though the noise that they make in their fall is like thunder, it is difficult to believe that it is caused by what appears but a thin stream of falling water. It is possible, however, to see them closer. At the foot of a deep ravine on the northern face of the Jungfrau there is a spot where they may be viewed in all their sublimity, and in perfect safety to the spectator. They fall from the upper portion of the Giessen glacier, the continuity of which is broken by the steepness of the sides of the mountain. A large block of ice, often many tons in weight, breaks off and falls with a loud crash, repeated again and again by the echoes to a distance of about two thousand feet, breaking itself by its fall into smaller fragments, till it reaches the head of the ravine already mentioned. The ravine is 1,000 feet deep, and down this the ice-balls leap and dash on to the head of a long uniform slope, which is really the continuation of the glacier above. Wind, in moderate blasts, accompanies the fall, and occasionally gushes of water, occasioned by the bursting of some sub-glacial reservoir. When the ice-balls reach the slope, they proceed along it in a swift but orderly manner to a distance of about 2,000 feet, and it is then that the nature of the ice can be seen. The diameter of the balls averages one foot. The larger balls are on the top, and help to grind those beneath them almost into powder. Between the first fall of the ice and the noise it makes is a sensible interval. The sound is not always continuous, but broken again into a sharp rattle, like the rolling fire of musketry, caused by the rebound of the larger pieces as they fall. An idea of the size of the blocks may be gathered from the measurement of the fragments of one that was found carried more than 1,000 yards down the Lower Grindlewald glacier. It was ten feet long, eight feet high, and six feet wide, and contained 480 cubic feet of ice. The powdered fragments, consolidated once more into a solid lump, help to form smaller glaciers, as is the case with the lower Giessen glacier, already mentioned. Except to adventurous travellers and explorers, the fall of these smaller ice avalanches is attended with little or no danger, as from their nature they occur only in the higher districts of the mountains. But sometimes it happens that the lower portion of a glacier, or even a glacier itself, breaks off or slides from its bed, with most disastrous results to the valley beneath. The Bies glacier, which lies on the steep eastern slope of the Weisshorn, 1,500 feet above the level of the valley, has on more than one occasion given way, and partially or wholly crushed the village of Rauda, which it overhangs. In December, 1819, a large mass of ice fell, which, though it did not touch the village itself, created so great a blast of air that most of the houses were levelled, and roofs and large beams were blown to a distance of more than a mile.

Wonders of Vegetation.

TREES STRUCK BY LIGHTNING.—Fig-trees and cedars are rarely struck by lightning; the beech, larch, fir, and chestnut are obnoxious to it; but the trees which attract it most are the oak, yew, and Lombardy poplar; whence it follows that the last are the trees most proper to be placed near a building, since they will act as so many lightning-conductors to it. Again, the electric fluid attacks in preference such trees as are verging to decay by reason of age or disease.

GIGANTIC TREES OF CALIFORNIA.—Professor Brewer describes the "big trees" as in great abundance on the western flanks of the Sierra Nevada, at from 5,000 to 7,000 feet altitude for a distance of more than twenty-five miles. One of the largest seen by Professor Brewer measured 106 feet in circumference at four feet from the ground, and was 276 feet in height.

CAOUTCHOUC.—There is no possibility of the demand exceeding the supply of this gum. The belt of land around the globe, 500 miles north and 500 miles south of the equator, abounds in trees producing the gum, and they can be tapped, it is said, for twenty successive seasons. Forty-three thousand of these trees have been counted in a

tract of country thirty miles long and eight wide. Each tree yields an average of three tablespoonfuls of sap daily; but the trees are so close together that one man can gather the sap of eighty in a day.

A BALL OF STARS.

A FORTUNATE person who has the opportunity of looking at the heavens through a first-rate telescope, should always ask to be shown a "globular cluster." There is no object in the sky which can compare with these systems in respect of the sublimity of the ideas which their contemplation evokes.

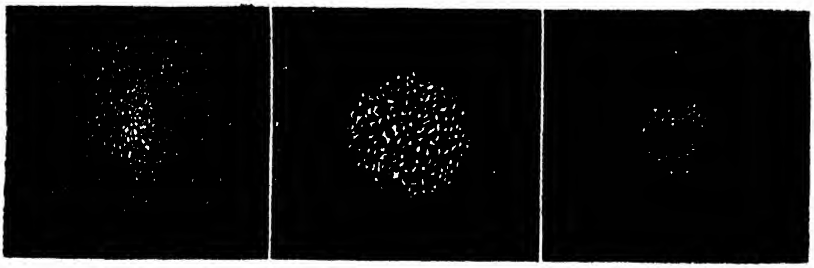
There are about a dozen of these wonderful clusters of stars known to astronomers, some of which are figured in the illustration. One or two of these clusters can, on a very dark night, be just seen with the naked eye as a faint spot of light on the black sky. The others are totally invisible without the aid of a telescope.

These bodies, or rather congregations of bodies, are small in apparent size; that is to say, they are not nearly so large as the apparent magnitude of the moon. They are round in outline, but they are composed of nothing else than myriads of stars clustered together. To give an idea of the enormous multitude of minute stars which compose one of these bodies, the following illustration suggested itself to an observer who had examined several of these objects through one of the finest telescopes in the world:—Take a piece of writing-paper cut into a circle about three inches in diameter, and shake a pepper-castor held over the centre of this piece of paper until the pepper is piled up in the middle so as to form a heap, gradually getting thinner at a distance from the centre, and finally ending with separate grains near the edge. Now, if we imagine each grain turned into a brilliant star, and the piece of white paper darkened into a black background, we get some idea of the marvellous way in which the stars are crowded together.

Herschel has calculated that in some of these clusters there are more than 2,000 stars visible; and when it is remembered that each star is brilliant, like our sun, we see how dazzling must be the splendour amid such a host of luminaries.

Astronomers know but little more of the nature of these clusters than what has been here described. The forces which are in action there by which these suns are held in the positions which they appear to maintain, are unknown. Some of these clusters are less dense than others. The illustration gives three. In two of these the stars are piled together in the manner described, while in the third they appear more open; but in this one the decrease in number is fully counterbalanced by the increase of size in the individual stars.

Increase of size! But what may be the size of these constellated suns? We think ourselves the great ones of the universe, and that the heavens were hung with their starry lamps to give light to our night. Have we any reason for our pride? Certainly none, if we measure our importance by our size. When compared with that our own sun is mighty. Conceive his size. Suppose that the fiery globe were hollow, and that our earth were placed at the centre; the moon could still hold on her way, though she is distant from us 240,000 miles; and yet there would be 200,000 miles beyond the moon ere the shell of the sun were reached. What a mighty mass! and yet, though so great, our sun is a speck of dust compared with the very smallest of the numberless stars which twinkle so peacefully above us. The nearest star is 18,918,000,000,000 miles from us; and Sir J. Herschel calculates that if a person stood upon that star and looked towards our earth, not only would our mighty sun be utterly invisible, but if the sun were so enlarged as to fit the earth's orbit—that is, instead of being 800,000 miles in diameter, he were more than 180,000,000 of miles in diameter—even then that stupendous orbit would be covered by a human hair held twenty-five feet from the edge, presuming the pupil of the eye were a point!



BALLS OF STARS SEEN THROUGH THE TELESCOPE.

In other words, those stars which cluster to form these mysterious balls cannot be less, and they may be infinitely greater, than luminous orbs having diameters of 180,000,000 of miles: orbs compared with which our earth is as an orange to the dome of St. Paul's; and yet there are thousands of such suns in one of these faintly luminous patches, scarcely visible to the eye!

FORMS OF SOUND.

In a former article we have shown how sound is generated. We now propose to say something of the various forms which its vibrations can be made to produce. These phenomena are illustrated in the following manner: A plate of glass or metal must be held between the finger and thumb at one corner, having been previously strewn over with some fine sand; then, if a fiddle-bow be drawn near one of its angles, the sand becomes agitated, and finally resolves itself into the form of a Latin cross, as in Fig. 1. If the bow be drawn near the middle of one of the sides, a St. Andrew's Cross will be formed. If the plate is pinched at the point O, in Fig. 2, the sand will immediately commence to form itself according to the shape therein shown; but if the plate be pinched a little nearer to the centre, the lines will become curves, as in Fig. 3.


Fig. 1

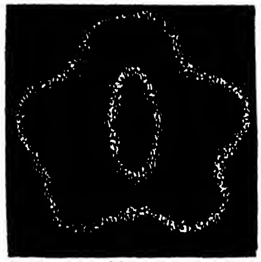


Fig. 4.


Fig. 2.

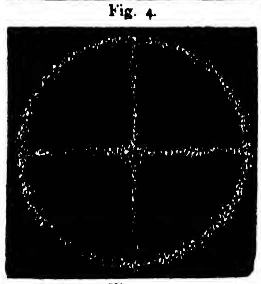


Fig. 5.


Fig. 3.

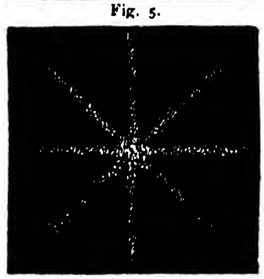


Fig. 6.

SOUND FORMS.

In Sir David Brewster's letters on Natural Magic, addressed to Sir Walter Scott, and published by Murray in 1832, the figures we have alluded to are elaborately described, as are also the forms that sand will assume when sprinkled upon a membrane that is agitated by sound, these forms varying with atmospheric influences. After describing the effects produced on a square plate, he says, "If the plate of glass is circular and pinched at its centre, and also at a point of its circumference, and if the bow be applied at a point 45 degrees from the last point, the figure of the sand will be as in Fig. 4. If with the same plate, similarly pinched, the bow is drawn over a part 30 degrees from the pinched point of the circumference, the sand will form six radii. When the centre of the plate is left free, a different set of figures is produced from those obtained before. When the plate is pinched near the edge, and the bow applied 45 degrees from the point pinched, a circle of sand will pass through that point, and two diameters of sand, at right angles to each other, will be formed, as in Fig. 5. When a point of the circumference is pressed against a fixed obstacle, and the bow applied 30 degrees from that point, Fig. 6 will be produced."

These forms, induced by sound, may be also seen upon a disc, which is agitated solely by the vibrations of air communicated from a plate in the manner before described. If a goblet glass, or any large glass with a stand, be taken, and some damp paper stretched across the mouth, the edges having been previously gummed to cause the paper to adhere, and some sand strewn on the surface when dry, the experiment made with a plate in any of the preceding forms will, if the plate is held horizontally over the tumbler, be repeated on the paper disc, any variation from the horizontal position in which the plate is held producing a variety of distinct mathematical forms in the disposition of the sand, which may be also varied if it be breathed upon, the sand, influenced by the temporary moisture, assuming a number of forms, until the perfect evaporation is complete, when the original shape is reproduced. Most of these experiments were tried, and may be occasionally yet practised, at the Polytechnic Institution, in London. An organ, or pitch-pipe, or a flute blown at the distance of a few feet, will produce a variety of figures in the sand, upon the stretched disc of paper; in the practice of which experiment our readers may make themselves acquainted with the varied shapes of the forms of sound.

The above are, of course, only a few specimens of the many curious and interesting experiments which may be made in this branch of science. The wonders of sound, like those of light, are inexhaustible, and some new marvel is continually being revealed. Of some others of the phenomena of sound it is our intention to treat in a future number.

THE GEORAMA, AND COLOSSAL MODEL OF THE EARTH.

One of the most pleasing contrivances for representing the Earth's surface was exhibited in Paris about thirty years since by its inventor, M. Langlard, who is said to have had his project in contemplation, and to have laboured in its completion for fifteen years. It was styled the *Georama*, and its mechanism was at once simple and ingenious. Ascending through the inferior pole of a colossal transparent globe 130 feet in circumference, the spectator, placed at the axis, contemplated, on the concave side of this spacious sphere, the uninterrupted representation of the surface of our terraqueous planet. This was given on a scale so considerable, and was so artistically executed, that while he had the satisfaction of comprehending clearly and instantaneously, and with the strongest impression, the forms and relative position, distance, and dimensions of all parts of the earth, he was astonished and delighted by the grandeur of the sphere, and the beautiful effects of painting and transparency which it presented to him. The varied outlines of the continents, islands, and coasts, the shading of the mountains, the traced lines of perpetual snow, the divers lines of the other regions, the fire of volcanoes, the contrasts between the aqueous parts, which were lucid, and the opaqueness of the tint of the *terra firma*, combined to produce a most interesting general picture. The general combination of this apparatus may be thus briefly described. Adopting the conventional divisions of geographers, the inventor employed the thirty-six meridians of the ordinary globe in as many curved vertical bars of iron, and seventeen circles of the same metal, marking the equator and parallels to constitute the skeleton of the sphere. The map was spread on the concave side, and the interior thus formed was illuminated by a soft and agreeable light, admitted through the blue transparency of the waters.

The manner in which the sphere was upheld was not disclosed to the public. The ascent into the globe was by an elegant spiral staircase passing through the antarctic pole, where the vast unexplored space admitted of this encroachment without prejudice to the map; three circular galleries projecting outwards from the staircase—one opposite the equator, the other two nearly on a level with the tropics—afforded accommodation for a numerous company, and opportunities for closer inspection and study of the geographical details.

In 1851 there was commenced the construction of a similar work to the above in the centre of Leicester Square, London, by Mr. Wyld, the well-known geographer. The ground was leased for ten years for £3,000, and Mr. Abraham, the architect, designed a circular building, ninety feet across. In this was placed a large globe, eighty feet four inches in diameter, lighted by day from the centre of the dome, as at the Pantheon at Rome, and by gas at night. The frame of the globe consisted of horizontal ribs, battened to receive plaster modelling; so as to figure the earth's surface inside instead of the outside of the sphere, and thus to show at one view the physical features of the world. The visitor passed into the interior by a winding staircase, and proceeded round it, viewing every part of the model at four feet distance from the eye. The scale upon which this model was constructed was of such magnitude as effectually to exhibit the details of hill and valley, lake and river, the great oceans occupying nearly 150,000,000 square miles; and the old and new continents, with all the islands, only 60,000,000 square miles; the gigantic model being made up of some thousand castings in plaster. The circumpolar regions were similarly illustrated, and by these ingenious means "the desert of Leicester Square was converted into a great geographical school."

Wonders of Animal Life.

A Gigantic Tortoise.—There are some hills in the East Indies, close to the great Himalaya mountains, which have large bones in them. These bones are found at some depth from the surface of the ground, and are of enormous size. They were washed down from higher ground by floods out of the bogs and marshy land, like those into which large animals, even at the present day, constantly stray and get drowned. One of the most wonderful animals whose bones are preserved in these hills is the *Colossochelys Atlas*. This Colossochelys (immense tortoise) is now extinct, and died out at the same time as a gigantic cameleopard and many kinds of immense elephants whose bones are very common in the same place. It was a tortoise which had a shell six and a half inches thick, twelve feet long, eight feet broad, and six feet high. There is a curious legend which states that the world is supported on the back of an elephant, and that this creature rests on the back of a great tortoise; and it is from this legend that the creature has obtained the name of Atlas.

Spiders.—There are in Ceylon spiders, with legs which would span an ordinary-sized breakfast-plate; and it seems to be now pretty well ascertained that these creatures seize small birds and feast upon their blood. There are also such spiders known in Australia and Hindostan. Their webs are strong enough to entangle and hold the small birds; and one species weaves threads, or rather cords, athwart the pathways, which once actually lifted Sir Emerson Tennent's hat off his head in riding. Small house-lizards are sometimes seized and devoured by these spiders.

THE GORILLA.—Dr. Wright states that a friend of his, who went out to report on the habits of the gorilla, observed that a female gorilla took her young to the sea-shore for the purpose of feeding them on oysters, which they opened with great facility.

EARLIEST LIFE.—The earliest distinctly organised animal to be found in the rocks is a trilobite, which ranks as the first created being, having a distinct and intelligible organisation.

CORAL FORMATIONS.—From the rate at which coral reefs are known to increase, Agassiz calculated the total age of those surrounding the peninsula of Florida at 135,000 years, and that of some human remains found in them at 10,000 years.

COPPER.

EVERYBODY knows the weight and value of an ordinary penny-piece, and that it is principally composed of copper; so that if any one were to find a great lump of that metal in the earth, weighing 420 tons, there would be a fine fortune. Such a mass of pure native copper was found in the Minnesota mine in 1857, and it was forty-five feet long, twenty-two feet broad, and eight feet thick. There is a piece of copper in the museum of Lisbon which came from Peru, and it weighs 2,616 pounds; and near Brunswick, in New Jersey, there was a thin sheet of pure copper found in the rocks which could be traced for several square yards. There are some very profitable mines near Lake Superior, between Canada and the United States, which often yield 8,000 tons a year of pure copper, and in 1853 a great lump of copper was found at Kewenaw Point, which weighed 200 tons, and was forty feet in length. It contained, moreover, much silver, and when the copper was cut and polished it looked very beautiful. In most parts of the world small pieces of pure copper have been found in cracks in the hardest rocks; and man, soon after he turned his attention to a civilised life, began to use copper. Then he mixed it with tin and produced weapons of bronze, which were used for a very long period before iron was discovered. The early natives of North America, like all others, first of all used sharpened stones as their knives and spear-heads, but they soon began to make use of the yellow metal they found every now and then amongst the rocks. They even tried to find copper, and obtained it from the mines on Lake Superior, for the present miners come upon the old diggings whilst working in places where gigantic trees and dense vegetation must have existed for thousands of years. Copper is usually found combined with other substances to form an ore, and this has to be burned and run into shapes before the pure copper is obtained. It is most probable that all copper, and even the great lumps of pure native copper, were once in the form of ore, or combined with other substances. Native copper is found close to rocks which are exactly like the lava and slag which are cast out of volcanoes. These rocks were forced into the earth whilst in a molten state, and their intense heat affected the copper ores close by. The substances combined with the copper to form the ore were destroyed by the heat, and the pure metal remained.

Wonders of Construction.

CURIOUS BIRDS' NESTS.

A LARGE volume might easily be written on the wonders of birds' nests. Every different kind of bird has a different kind of nest, and each pair always adhere to the peculiar style of architecture of the particular species to which they belong. So characteristic is the nest, that an experienced collector could, when shown one, immediately name the bird by which it was constructed.

Birds themselves differ so much in form, in size, and in their modes of life, that we should expect to find great differences in the requirements of their young; but it would be a hopelessly long task to attempt to give even an outline of the various constructions which are employed. All we shall do will be to mention some of the most curious of these beautiful contrivances, and to point out, wherever possible, the reasons which appear to have guided the little architects in their plan.

Our first illustration represents the nest of a little bird found in India, and known, for a reason that will presently appear, by the name of the tailor-bird. On a leaf or two at the extremity of a slender twig is the little cradle made. If one leaf be sufficiently large, the edges are drawn together so as to form a pouch, in which the nest is formed. To preserve the pouch, the parent birds twist vegetable fibre into a fine thread, and by the help of their bills and feet actually bore holes through the edges of the leaf and stitch them together. If one leaf be considered too small, then another growing by, or a dead one, is stitched on to it, so as to form a pouch roomy enough to contain the expected family. The inside is then completed by being carefully lined with down and feathers. This is truly a rocking-cradle, for, hanging from a leaf, it is, of course, moved by every breath of wind; but the little tailor-bird has a formidable enemy, which it is necessary to avoid. Tree-snakes infest the trees in India, and young birds and eggs form their favourite prey. Did the tailor employ his art anywhere but on the finest twigs, the snake would be able to visit his domicile; but by placing his nest in the position he selects, the unwelcome intrusions are completely prevented.

The nests of the Pensile weaver-bird are represented in the second figure. They are always suspended from the twigs of trees overhanging water, and form an object of curiosity to the traveller in Africa. Each consists of a hollow globe, which, when rendered soft and warm by being lined with feathers, constitutes the nest properly so called; doubtless the same fear of snakes which guides the tailor-bird. The instinct of these ingenious creatures shows them how to evade their active and insinuating enemy, who dares not venture out upon the slender twigs from which these nests are suspended. The weaver-birds are so called from the mode in which they make their nests and the tubes

Fig. 1.

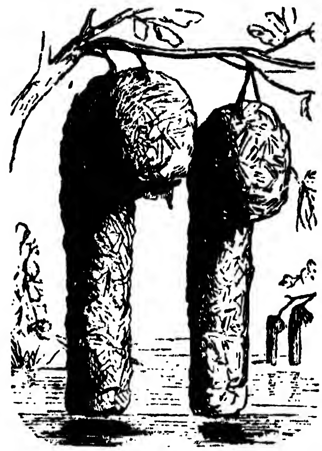


Fig. 2.

Fig. 3.

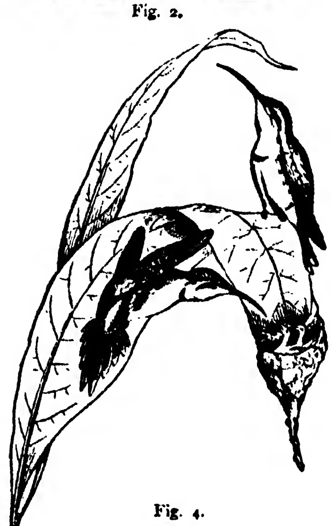


Fig. 4.

CURIOUS BIRDS' NESTS.

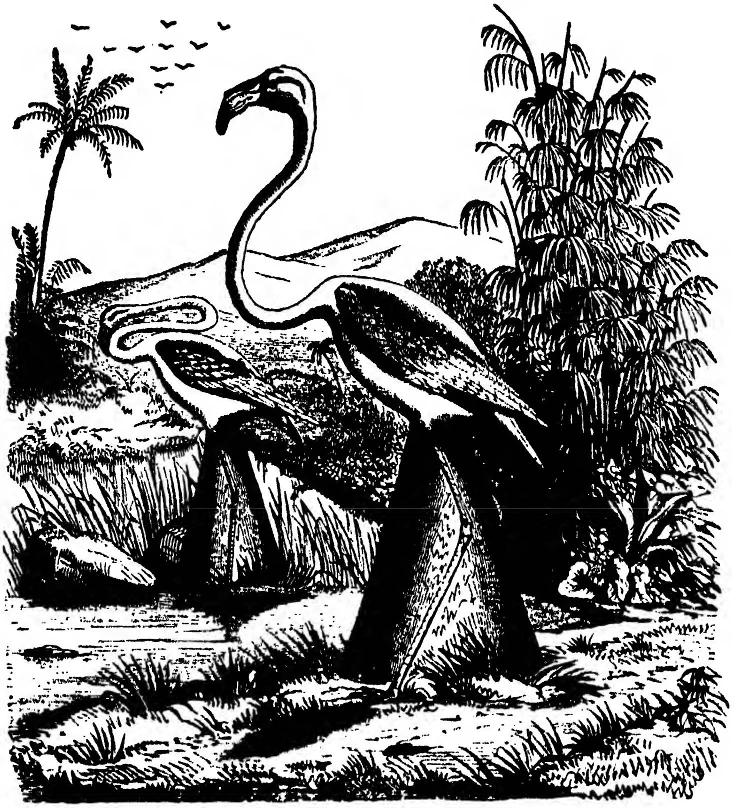
but the peculiar feature of this construction is the passage by which the weaver enters his home. There is a tube about a foot or fifteen inches in length, made of the same material as the nest; one end of this tube opens into the chamber, the other goes down to within a few inches of the surface of the water. Into this nest none but a flying creature could enter. It cannot be approached but by the tube, and to the mouth of this tube there is access neither by land nor water, but only through the air. The object of this curious contrivance is which hang from them. These are formed of dried grasses, which are so beautifully interwoven as to form a very compact and strong case. Thus these birds have anticipated man in weaving, as the tailor-birds have in sewing.

Figure 3 represents the nests of the sociable grosbeak, a bird found in South Africa. It may be described as a colony of nests packed under one roof. Like our common rook and many other birds, the grosbeak is fond of the society of its kind; but, unlike them, it is not satisfied with having

its neighbours' nests on adjacent branches of trees; they must all be close together. When a number of these birds agree in forming a habitation, the first thing to be made is the roof. A large and lofty tree is selected, and in the topmost branches of this the birds, numbering perhaps some hundreds, commence their labours. With coarse grass they form the roof, strengthening it by interweaving the fibres: this having been accomplished by the joint efforts of the community, each individual pair constructs its own nest under the shelter thus provided. These are placed side by side, and when the whole are finished the entire under surface is covered with the circular openings leading to each nest. Three or four eggs are laid by each female, and as many as 320 nests have been counted under one roof. The feeding and rearing of a thousand young makes a very busy scene. It is not known what may be the object which is gained by this union of birds into a republic; possibly it may be for mutual protection against some common enemy.

The fourth illustration shows a pair of humming-birds from South America, and the nest which they have constructed at the end of a leaf. A slender support indeed has the nest, but then it must be remembered that the humming-birds are the smallest of the feathered tribes. Some of them are not larger than the humble-bee, which we know so well in this country. Their nest is proportionately small, consequently it and the eggs or young can be easily sustained, even by the very small support which they appear to have in the illustration.

From the nest of the smallest bird we pass to that of a great bird upwards of five feet high. It is found on the sea-coast of Africa, and is called the Flamingo. The plumage of these noble birds is most splendid, being a combination of carnation hues with delicate white. A row of them standing together is a most striking spectacle. The neck is long, but the bill is so strangely shaped that it seems difficult to understand how it is used for procuring food. The nest is curiously constructed, and their mode of sitting upon it is most extraordinary. They scrape together a hillock of earth, as shown in the illustration above; then, a hole having been made in the top, two or three eggs, each as large as goose-eggs, are laid. The female sits upon them, with her legs resting at either side on the ground, or sometimes even in shallow water, from which, as a sort of island, the hillock rises.



THE FLAMINGO AND ITS NEST.

PALISSY THE POTTER.

A LITTLE over three hundred years ago sat Bernard Palissy, troubled in spirit, rugged of brow, and worn with patient watching. Poor in this world's goods, he had devoted himself to the idea that by discovering the secret of enamelling pottery, and joining that to his skill as a draughtsman, he might bring up his family in a creditable fashion. He was a glass-painter by trade, but finding his profession thriftless, and unable to draw from it a sufficiency to meet his increasing expenses, like many another great man, he had taxed his powers of invention till there shone before him, like some *ignis fatuus*, the bright object of his desires, and sixteen long years passed before he could grasp and hold it with the conqueror's hand. For Palissy lived at a time when men groped blindly amongst the wonders of chemical science, and the task he had set himself to achieve was almost superhuman. But, steadfastly setting his face towards the object in view, he persevered to the end.

Palissy's aim was in the first place to discover such chemicals as, when mixed and laid upon a rough clay vessel, should, upon the application of heat, fuse, and form upon that rough earth a beautiful white enamel, similar to that seen upon the chinaware of our own day: no light task, when it is taken into consideration that he was entirely ignorant of the nature of the articles he used. The white enamel once discovered, to give to it various tints would be a task of far less difficulty; and in his imagination he designed endless forms of fictile beauty—dreams destined to be realised only after a long and arduous struggle. The difficulties to be encountered were innumerable, for Palissy was poor, and wanting in the ordinary appliances for his work; but he toiled on, breaking and powdering his drugs, and applying them in various experimental quantities to fragments of earthenware before exposing them to the heat of a small furnace or the kiln of some friendly potter. Now one drug would fuse, while another remained untouched; now every mixture grew calcined, and fell away in powder; but no appearance of a glaze was formed. He devoted every instant that he could steal from the bread-winning for his wife and children, and every coin he could spare to the purchase of new preparations, but still with the same ill-success; till, amidst poverty, despair, and ruin, he grew to be the reproached of his wife and neighbours; and still he strove on patiently, ever keeping his aim in view. Great as were the difficulties he had to contend with in discovering earthy substances that should answer his purposes, there was one greater still, and that was poverty. With brightening eye he would watch the preparations he had made, each time feeling sure of success; and, as he exposed them to heat, and fed his furnace with scrap after scrap of fuel, the longed-for moment was expected when the powdery substance should begin to fuse, melt gently, and flow over the rough clay, forming a beautiful glaze, afterwards to be applied to many a varied form of beauty. But the moment did not come, the salts and powdered flints remained stubborn. The heat was not sufficient, and with trembling hands scrap after scrap of fuel was applied to increase that heat, until in his eagerness the garden palings were torn down and burned bit by it. No effect: more heat must be had, though he was penniless, and could purchase no fuel. This time might be the one when the difficulty would be solved, and then riches would follow. The furniture was cast into the furnace piecemeal, even the very boards of the floor of his house were burned; and then, as he gazed on till the glowing and waning fire sank slowly and paled, he turned away with aching heart to meet the despairing looks of reproach from his wife, and sighed as he gazed upon his ill-clad and poorly-nurtured children.

For he had failed again, as he had failed scores of times; but, unconquerable, he fought on, mixing, powdering, weighing, and noting down, year after year, whenever he could steal a few coins from his household necessities; and his hopes were realised at last—the white enamel was upon a piece of potsherd, and then followed enamels of various tints, with which he coated vases, ornamented with reptiles, fishes, fruits, and flowers in strong relief; and in time his rustic ware became the rage, so that his difficulty was to fulfil his manifold commissions for this new and strange ware, rich with objects of nature standing out in enamel of their own proper hue, and so valued that at the present day large sums are given for their possession.

But, though wealth rewarded his discovery, the life of Palissy was not to be one of peace; he lived in the troublous times of the Reformation, and narrowly escaped death in the massacre of the Huguenots; even the patronage of the French king not sufficing to save him from dying a prisoner for his religion in the Bastile.

Scientific Wonders.

THE DIFFUSION OF POWERFUL ODOURS.—It is said that a grain of musk is capable of perfuming for several years a chamber twelve feet square without sustaining any sensible diminution of its volume or its weight. But such a chamber contains 2,985,984 cubic inches, and each cubic inch contains 1,000 cubic tenths of inches, making in all nearly three billions of cubic tenths of an inch. Now it is probable, indeed almost certain, that each such cubic tenth of an inch of the air of the room contains one or more of the particles of the

musk, and that this air has been changed many thousands of times. Imagination recoils before a computation of the number of the particles thus diffused and expended. Yet have they altogether no appreciable weight and magnitude.—*Moseley's "Illustrations of Science."*

VELOCITY OF LIGHT.—Foucault condensed into his own apartment an experimental proof of the velocity of light, and within a tract of thirty feet determined the rate of the movement through all the vast planetary spaces of millions and thousands of millions of miles, more exactly than had been inferred by astronomers from observations of the satellites of Jupiter. Foucault ascertained the velocity to be 160,920 geographical miles in a second.

A MAGNETIC MOUNTAIN has been discovered in Swedish Lapland. It is traversed by a vein of magnetic iron, several feet in thickness, and said to be the richest hitherto known. The owner hopes to supply all the world with loadstones of great power. One of these, weighing sixty-eight Swedish pounds, has been acquired by the eminent electrician, Professor Dare, of Berlin.

WONDERS OF COAL.

WHEN it is remembered that it takes ten sacks, each being a tolerable load for a strong man, to get rid of one ton of coal, we may indeed wonder how 104,500,480 tons of it were dug out of the earth of the United Kingdom and supplied to consumers in 1867. The average price of a ton of coal in the London market was 18s. 1d. in 1867, so that the value of the mineral to the country can be calculated easily; but it must be also borne in mind that more than 10,500,000 tons were supplied to foreign countries, which had to be paid for by the foreigner at an advanced price. All this coal was derived from 3,258 mines, and was got out of the coal seams deep down in the earth by thousands of men, horses, and steam-engines, who were paid, fed, and kept going by the expenditure of millions of money. Even the counties of Durham and Northumberland yielded 24,867,444 tons in 1867, and the value of this great mass to the coal-owners must have been at least eight millions and a half of sovereigns, and to this the ship-owners, the railways, and the coal-merchants added their profit, which came to as much more.

It is the amazing amount of labour, perseverance, and intelligence required to carry out such great transactions that excites the wonder of those who look into the coal question. These two counties consume very little of their coal, which is sent to all parts of the world, even to Iceland and the Sandwich Islands, but principally to the great towns of England. The following is a table of what became of the produce of Northumberland and Durham coal in 1867:—

Coal exported to foreign countries	
computed as coal	
Coal sent coast-ways	6,065,457
[illegible]mputed as coal	21,697
Coke	
Colliery c[illegible]	
Consumpt[illegible]n in the district, and in the district manufactures	
Total ...	24,867,444

This quantity came from 307 mines, and was all used. Other countries have coal-mines besides England, and many millions of tons of coal are dug up and used in North America, France, Belgium, and even in Australia. One set of coal-mines—or, as it is called, a coal-field—in North America, is much larger than the whole of England, being 730 miles long and 180 miles broad, and the importance of this region may be estimated when the size of the counties of Durham and Northumberland is considered with reference to the whole of England.

The great value of coal arises from its power of producing a great amount of heat from a small bulk in a short space of time. The amount of heat that a pound weight of coal, set on fire in a good draught, will produce, is wonderful, and it can be measured by the warmth it will impart to a kettle of cold water suspended over it. This heat is produced by the burning of the gases of the coal in the air of the atmosphere, and by the capacity for retaining heat which the solid part of the coal possesses. If a piece of coal be placed in the bowl of a pipe, and we then cover it with a lump of clay, and put it in a fire, leaving the end of the pipe outside, some steam comes off, and then a strong-smelling gas, which is the same as is burned in gaseliers. This gas can be collected by letting it bubble up through water into a phial full of water turned upside down. When all the gas has come away, if the bowl of the pipe be examined, what is called coke will be found instead of the piece of coal. Coal consists, therefore, principally of gas and coke, and there is besides a liquid which is produced during the gas-making, called coal-tar. The gas we burn in large quantities, and when properly managed is a great source of comfort; but when it collects in a room it will explode if a light be brought in, just as it does in the long tunnels of coal-mines. When the gas burns, it combines with a part of the air called oxygen gas, and the products of the combination or burning are heat, light, and water. Water is made up of oxygen gas and hydrogen gas, and the coal-gas is impure hydrogen. Besides the water, there is produced—in small quantities in a room, but in great quantities in coal-mines—a gas called choke

gas, and it is this that is so fatal to the poor miners who have been fortunate enough to have escaped the first results of the explosions.

Coke often looks like charred wood, and it is really so, for many years since it was discovered that coal was altered wood and vegetable matter. The coals we burn are carefully picked out for that purpose; but when the mineral is brought up from the mine it contains impressions of fern-leaves and of trunks of palm-like trees. Some of these impressions are very beautiful, and geologists have studied, described, and drawn no less than 934 kinds of plants which have been noticed in the coal of all parts of the world, some of which are very much like plants now living in tropical climates. Large succulent trees are often found in the coal turned into that mineral, and their roots are still fixed in the clay beneath the layer or seam of coal. Besides leaves and fir-cones, many other vegetable matters are found, and they are frequently so well preserved that the microscope detects the delicate structure which characterises them at the present day. Many animals and insects are found in the coal, such as huge toad-like reptiles with beautiful teeth, small tree-lizards, water-lizards, great fish with tremendous jaws, tiny water mites, a sort of snail, hundred-legs, and many insects of the grasshopper and dragon-fly tribes. But none of these are of the same kind as those now living on the globe.

Before coal is found, many layers of soil, sand, clay, and stone have to be dug through; and, after passing through hundreds of feet of them, it is found as a thin layer or seam extending over a large surface. A clay is found beneath it, then more sand and water, then a thicker seam with clay beneath, and so on for many feet down. One monster seam is as much as thirty feet thick. It is evident that the lowest coal-seam was formed first; it was a swampy forest, and the rotten branches and fallen leaves mixed with the water-plants and formed a black bog. Sand and mud gradually covered it up, and it sank beneath the surface of the ground, for rolled pebbles and sand are found on it, and they can only be produced by running water. After a while a fresh forest formed, decayed, and was covered up in its turn; and this destruction and re-formation went on for ages, for in the cliffs of Nova Scotia the coal-seams can be seen one over the other for many hundred feet. Beneath the coal-seams there is a limestone which forms great mountains in some parts of England; and when a piece of it is polished and examined, many beautiful shells, corals, feather stars, and minute creatures may be seen. It is supposed that this limestone was principally formed by coral insects and the other minute beings that live on coral reefs and near coral islands. If this is correct, what a wonderful amount of life there must have been during the ages when the coral was being deposited; and how much the state of things then is like those now in existence round and about the coral islands, with their mangrove swamps in hot climates! The sun gave his heat and light to the forests now turned to coal, and when we burn it, although ages afterwards, we return some of the heat and light kept so long entombed.

Effects of Strong Mental Emotion.

Death from Joy.—In the time of Queen Mary, there was a gentleman of Shropshire, Edward Burton, of Longnor, who was strongly attached to the reformed doctrine. He was an aged man, but his feelings were alive to the miseries of his country and the afflictions of the church. The reports of the queen's illness had reached his residence, near Shrewsbury, when one morning the church bells of St. Chad's were heard to ring merrily, and he thought these sounds might announce the accession of Elizabeth to the throne. His son undertook to go and learn the news; and, as the road by which he would return passed in front of the house on the opposite side of the river, to reach the bridge below, it was agreed that, if the surmise should prove true, he should wave his handkerchief as he passed, to signify it to his father. The old man watched for his return, and saw the signal: it told of restored peace and liberty, not to himself only, but to his country and his religion; and he went into his house, breathed his *Nunc dimittis*, and laid him down and died. —*Massingberd's* "*English Reformation.*"

The Hair turned White by Grief.—Many instances are recorded to establish the fact that sudden alarm or great distress will, as Sir Walter Scott has said, "blanch at once the hair." The hair of Ludwig of Bavaria, who died in 1294, on his learning the innocence of his wife, whom he had caused to be put to death on a suspicion of infidelity, became almost suddenly white as snow. The same thing happened to the Hellenist Vanvilliers, in consequence of a terrible dream; and also to the French comedian Blizard, who, having fallen into the Rhone, remained for some time in imminent danger of his life, clinging to an iron ring in one of the piles of a bridge. A like change was wrought in the case of Charles I., in a single night, when he attempted to escape from Carisbrooke Castle. Marie Antoinette, the unfortunate queen of Louis XVI., found her hair suddenly changed by her distresses, and gave to a faithful friend her portrait inscribed, "Whitened by affliction." The beard and hair of the Duke of Brunswick whitened in twenty-four hours, upon his learning that his father had been mortally wounded in the battle of Aurstadt.

THE IVORY PLANT.

So different are the products of the animal from those of the vegetable kingdom, that even the most careless observer may be expected at once to distinguish them. Yet multitudes are in the daily use of ivory buttons, boxes, and small ornaments, who never doubt that they are made from the tusks of the elephant, while they are really the product of a plant.

The ivory plant is a native of the northern regions of South America, extending northwards just across the Isthmus of Panama, large groves of it having been recently discovered in the province

GROVE OF IVORY PLANTS (PHYTELEPHAS MACROCARPA)

of that name It is found in extensive groves—in which it banishes all vegetation from the soil it has taken possession of—or scattered among the large trees of the virgin forests.

It has the appearance of a stemless palm, and consists of a graceful crown of leaves twenty feet long, of a delicate pale green colour, and divided like the plume of a feather into from thirty to fifty pairs of long narrow leaflets. It is not, however, really stemless, but the weight of the foliage and the fruit is too much for the comparatively slender trunk, and consequently pulls it down to the ground, where it is seen, like a large exposed root, stretching for a length of nearly twenty feet in old plants. The long leaves are employed by the Indians to cover the roofs of their cottages.

Each flower of the ivory plant does not contain stamens and pistils, as in most of the British plants, but, like our willows, one tree produces only staminal flowers, while another has only pistillate ones. Such plants are said by botanists to be diœcious. Both kinds of the plants of the vegetable ivory have the same general appearance, and differ only in the form and arrangement of the flowers. In the one kind an innumerable quantity of staminal flowers are borne on a cylindrical fleshy axis, four feet long, while in the other a few pistillate flowers spring from the end of the flower-stalk. Each plant bears several heads of flowers. Purdie, who visited the plants in their native locality in 1846, says, "The fragrance of the flowers is most powerful, and delicious beyond that of any other plant, and so diffuse, that the air for many yards around was alive with myriads of annoying insects, which first attracted my notice I had afterwards to carry the flowers in my hands for twelve miles, and though I killed a number of insects that followed me, the next day a great many still hovered about them, which had come along with us from the wood where the plants grew."

The group of pistillate flowers produce a large roundish fruit, from eight to twelve inches in diameter. and weighing when ripe about twenty-five pounds. It is covered by a hard woody coat, everywhere embossed with conical angular tubercles, and is composed of six or seven portions, each containing from six to nine seeds. These seeds, when ripe,

are pure white, free from veins, dots, or vessels of any kind, presenting a perfect uniformity of texture surpassing the finest animal ivory; and its substance is throughout so hard, that the slightest streaks from the turning-lathe are observable. Indeed, it looks much more like an animal than a vegetable product; but a close comparison will enable one to distinguish it from the ivory of the elephant, by its brightness and its fatty appearance, but chiefly by its minute cellular structure.

This curious hard material is the store of food laid up by the plant for the nourishment of the embryo, or young plant contained in the seed. It corresponds to the white in the egg of the hen, and has been consequently called the albumen of the seed. In its early condition this ivory exists as a clear insipid fluid, with which travellers allay their thirst; afterwards the liquor becomes sweet and milky, and in this state it is greedily devoured by bears, hogs, and turkeys; it then gradually becomes hard. It is very curious that this hard mass again returns to its former soft state in the process of germination. The young plant for some time is dependent upon it for its food, and if the seed be taken out of the ground after the plant has appeared, it will be found to be filled with a substance half pulp and half milk, on which the plant lives until it is old enough to obtain its food on its own account.

From the small size of the seed, the largest not being more than two inches across their greatest diameter, the vegetable ivory can be employed in the manufacture of only small articles, such as beads, buttons, toys, &c. What is wanting in size is, however, often made up by the skill and ingenuity of the workman, who joins together several pieces so as to make a long object (especially when such articles are made by the turning-lathe, when it is easy to hide the joints from view), or makes a lid from one seed, and the box from another. In some years as many as 150 tons of seeds have been imported into England, and they have been sold in the market at the rate of a thousand nuts for seven shillings and sixpence.

WONDERFUL TERRACES.

There are many instances of curious flat projections from the sides of mountains, like roads, in many parts of the world. They are well known in Glen Roy, in Scotland, where, from their regularity one over the other up the valley for miles, they have been considered the roads of some old Scottish king. On Lake Superior, in North America, the hills by the side of the shore have many terraces or roads, one over the other, and the topmost are many scores of feet above the present level of the water. On the Fraser River, in the far west of North America, the terraces rise one over the other up the sides of the curious conical mountains; and from their level course, width, and regularity, they simulate the careful work of engineers. How were these terraces produced? It is clear that man had nothing to do with them, and that the water close by might have fashioned them. The parallel roads of Glen Roy, as these terraces are called, and those on the Fraser River were formed before the valleys were as much scooped out as they are now. During the ages of time the river, which formerly flowed on a level with the highest terrace, had huge blocks of ice upon it during the winter, and these scored the sides of the hills and wore away the cone above the highest terrace of the Fraser. Then, as the land rose and the river cut its way deeper, a terrace was left as far above the river as the lowest terrace now is. The same wearing away was exercised upon the mountain below the upper terrace, and the stones rolled down and formed a bank, which, when worn by ice, became the second terrace, and so on. Since the land has ceased to rise, the present banks of the river are the lowest terrace; but should the river cut more deeply into its bed, the bank-terrace would be higher than it now is, and, therefore, would become a more prominent feature in the landscape.

Wonders of Animal Life.

Crabs Moulting.—According to the observations of Sir John G. Dalyell, the time occupied by crabs in moulting varied from 64 to 194 days from one moult to another; and in all cases no separation of wounded, mutilated, or destroyed parts took place till after the moult following the injury. The process of shedding seems to be in great measure under the control of the animal, as when watched it frequently suspended this operation, or when excited hastened it, and was more pugnacious than at any other period.

Marine Vermin.—The skeleton of a marine bird was lately presented to the Boston Natural History Society, which had been prepared in the short space of two hours, by exposure to vermin on the banks of Newfoundland. The creatures live at or near the sea-bottom, and are said to be very destructive to the cod-fish frequenting the banks. The bird was lowered to the bottom by means of a loaded line, and drawn up in two hours, a perfect ligamentary skeleton, the flesh having been entirely consumed.

An Animal poisoning itself by its own Virus.—The virulence of the poison of the rattlesnake is well known. Dr. W. J. Burnett, of the Boston Society of Natural History, states there is good reason for belief that the action of this poison is the same upon all living things, vegetables as well as animals. It is even *just as fatal to the snake itself, as to other animals*, for Dr. Dearing

states that one of his specimens, after being irritated and annoyed in its cage, in moving suddenly, accidentally struck one of its fangs into its own body, when it soon rolled over and died. Here, then, we have the remarkable, and perhaps unique physiological fact, of a liquid secreted directly from the blood, which proves deadly when introduced into the very source (the blood) from which it was derived.

POUCH OF THE MARSUPIALS.—The distinguishing characteristic of Australia, the true land of marsupials, is its extreme dryness; and it has been supposed by physiologists that the object of this peculiar organisation of these animals is to enable them to transport their young, when they are obliged to traverse great distances in order to obtain the means of quenching their thirst. If no such contrivance as the pouch of the marsupials existed, the young would probably perish while the mother wandered about in search of water.

THE ELEPHANT.—The erroneous idea, formerly prevalent, that elephants only sleep standing, may probably be attributed to some such circumstance as that of the wild animals, when undergoing the process of domestication, having occasionally been known to stand for twelve months without lying down to sleep: this is regarded as a symptom of want of confidence in their keepers, and of a longing desire to regain their liberty; whereas, when they are perfectly at ease, and reconciled to their fate, they will lie down on their sides, and sleep like other beasts.

THE DIVINING ROD.

THE employment of this pretended power to discover water or mineral treasure is no longer common, as it was in the last century. Still, in mining districts it is more believed in than is generally supposed. In Cornwall, less than twenty years ago, not only the miners placed much confidence in its indications, but many highly intelligent men employed the divining rod, or engaged the diviner in seeking for mineral wealth on their estates. In Lancashire and Cumberland the belief of the powers of the magic rod was then widely spread. The divining rod was commonly a forked stick, which, when grasped in both hands, was supposed, by spontaneously turning in the hands of the operator, to indicate the presence of water, metals, or hidden treasure beneath the surface of the earth. Sometimes a simple stick was used for the purpose of ascertaining whether a person possessed the power of causing the rod to turn; for, after all, the property seems to have been attributed to the holder more than to the stick, since with many no movement whatever took place. To ascertain the possession of this faculty, the stick was laid flat on the hand, and the hand passed over a vessel of water; when, if the stick showed the least indication of motion, the holder was supposed to possess the requisite faculty. A believer in the virtues of the divining rod gives the following directions for its use:—The rod being properly held by those with whom it will answer, when the toe of the right foot is within the semi-diameter of a piece of metal (placed under the foot for the purpose of experiment), or other subject sought to be discovered by the use of the rod, it will be repelled towards the face, and continue to be so while the foot is kept from touching, or being directly over the object, in which case (that is, when the foot is over the object), it will be sensibly and strongly attracted, and be drawn quite down. The rod should be firmly and steadily grasped; for when it has begun to be attracted, if there be the least imaginable jerk or opposition to its attraction, it will not move any more till the hands are open and a fresh grasp taken. The stronger the grasp, the livelier the rod moves, provided the grasp be steady and of equal strength. When the rod is drawn down, the hands must be opened, the rod raised by the middle fingers, a fresh grasp taken, and the rod held again in the manner described.

The working of the deception is plainly to be seen: First, the operator must have entire confidence in the virtues of the rod. A man possessing full faith in its power will readily fancy, after moving a short distance, that he feels some indication of motion in the rod. Unwilling to be deceived, he grasps the rod more firmly to prevent this movement; the tendency to point to the earth increases; he exerts his whole power to restrain it, but the more firmly he opposes the motion, the less able he is to prevent it; he becomes satisfied of its powers, and relates his experience to others.

In *Blackwood's Magazine* for May, 1850, we read that "the seekers for water carry a rod of willow; this they hold horizontally, and by the bending of the rod towards the ground, they discover the favourable places for *sinking wells;* a matter of considerable importance in a province so ill-watered as the northern district of Somersetshire, and for twenty miles round Wrington, the birthplace of Locke. Nobody sinks for wells without their advice. A Scottish family built a house in Somersetshire, and resolved to find water without help from the *jowser* (as the diviner is called). But after sinking to a greater depth than ever had been known before, and spending nearly £200, they were finally obliged to consult the jowser, who found water at once." Some of our readers may have seen the assurance on the sign-boards of well-sinkers—"engages to find water in any part of the country"—which is a relic of this practice.

The Abbé Richard is stated in the *Monde* to possess the singular faculty of discovering water. "We do not exaggerate," says the account, "in

ffirming that the Abbé Richard possesses such an ntuitive knowledge of the law which regulates the irculation of water in the bowels of the earth, hat he can detect springs at a distance without abour, or any mental exertion. Examples of his xtraordinary skill (continues the *Monde*) are not vanting. At Glouchow, between Cracow and Lemerg, in a close belonging to Count Potocki, where here were three wells dried up, although they were hirty metrès deep, he pointed out a spot between hose wells where water might be found at a depth f four metrès, and his prophecy was confirmed on he following day. The commune of Metternich, ear Coblentz, was so sparingly provided with vater that there was not enough for the common ses of the inhabitants. The Abbé Richard discovered a spring there in the very centre of the market-place, which now feeds the 'Christmas Fountain,' solemnly inaugurated there on the 25th of December, 1863. On M. de Metternich's celebrated estate of Johannisberg, which, though rich in wine, s poor in water, M. Richard pointed out a spring, he supply from which is now conveyed in an queduct to a spot near the palace."

Mr. W. Phillips, the geologist, tells us that the divining rod was ably advocated by De Thouvenel, n France, in the eighteenth century, and soon after n our own country by a philosopher of unimpeachable veracity, and a chemist, Mr. Cooleworthy, of Plymouth.

There is a long story in the *Quarterly Review*, No. 44, showing that a Lady Noel possessed the faculty of using the divining rod. "She took a thin forked hazel-twig about sixteen inches long, and held it by the end, the joint pointing downwards. When she came to the place where the water was under the ground, the twig immediately bent, and the motion was more or less rapid as she approached or withdrew from the spring. When just over it, *the twig turned so quick as to snap, breaking near the fingers*, which, by pressing it, were indented and heated, and *almost blistered;* a degree of agitation was also visible in her face. The exercise of the faculty is independent of any volition." The editor of the *Quarterly Review* adds, that upon the narrator the most implicit confidence may be placed.

The divining rod was commonly called *Moses' Rod*, probably from the rod with which Moses struck the rock when water gushed forth in the wilderness.

CORONATION OF HAROLD. FROM THE BAYEUX TAPESTRY.

THE BAYEUX TAPESTRY.

In the Hôtel de Ville at Bayeux, in Normandy, is preserved one of the most curious and interesting relics of the middle ages which have come down to our own times. It is a pictorial representation, in needlework, of the chief events connected with the Norman Conquest of England; and tradition asserts that it was the work of Matilda, queen of William the Conqueror, and the ladies of her court. It is not questioned that this tapestry is a work of great antiquity, and of date almost contemporaneous with the period to which it is assigned; but some critics have ascribed it to the twelfth instead of the eleventh century, and given the credit of its design to another Matilda, the daughter of Henry I. As professed antiquaries disagree upon the matter, we cannot take upon ourselves to decide the point; but it may be remarked that, while the wife of

William might more naturally desire to make such a commemoration of her husband's achievement, nothing that we know of the Empress Matilda, his restless and warlike granddaughter, warrants the supposition that she would be so likely to engage in a peaceful pursuit of this laborious nature.

Seventy-two different scenes are represented in the tapestry, some of them containing a great number of figures—men, horses, ships, buildings, warlike implements, &c. They are executed with remarkable spirit, and, although the drawing is that of a rude age, and there is an entire absence of perspective, the scenes are exceedingly well executed, considering the state of pictorial art at the time, and the material in which they are worked out. Each scene has a compartment to itself, and an explanatory inscription in Latin. Collectively, they embrace the whole history of the Conquest, from the departure of Harold for the court of William, in Normandy, and the circumstances which transpired there, onward to the death of Edward the Confessor, the crowning of Harold, the landing of William, the battle of Hastings, and Harold's death on the field.

WILLIAM ADDRESSING HIS SOLDIERS BEFORE THE BATTLE OF HASTINGS.

The total length of the tapestry is about 220 feet, and its width is twenty inches. The material of which it is composed is canvas or linen cloth, embroidered in wool of various colours. The figures are made by lines of woollen thread laid down upon the canvas, and stitched over crosswise to secure them. In the parts intended to represent flesh, the surface of the canvas is untouched. The canvas itself has become brown with age, but the wool has apparently retained its original colours.

Some incidents are depicted in the Bayeux Tapestry which have not been mentioned by historians; but what makes it peculiarly valuable is the light it throws upon the manners and customs of the times. As regards costume, arms, &c., there is nothing at once so graphic and authentic in existence relative to the period. The sports of the time, the regal state of kings, the character of the buildings, and similar subjects receive incidental illustration in the course of this highly interesting series of pictures; and the needlework of the fair Matilda and her maids therefore ranks in importance with any of the written records of the time.

The tapestry was originally deposited in the cathedral of Bayeux, as a memorial of the aid rendered to William in the invasion by Odo, his half-brother, who was bishop of that city. Its existence appears to have been unknown or forgotten until early in the last century, when it was discovered through the researches of some French antiquaries. Afterwards it was the custom to exhibit it once a year to the people in the nave of the church. When Napoleon I. was meditating the invasion of England, he had the tapestry taken to Paris, and displayed in the National Museum, apparently with a view of exciting the ardour of the populace, and encouraging them to enter into his project. It was returned to Bayeux, where it is now exhibited under glass in the public library.

HEAVY RAINFALLS, AND THEIR CAUSES.

We measure rain by catching it in a vessel called a rain-gauge, the area of whose mouth is accurately known, and then calculate how deep the layer of water would have been if all the rain that fell into the gauge had been spread out evenly on a surface of the size of its mouth. A gallon of water would only cover a space of two feet square if spread out in a layer an inch thick. Accordingly, an inch of rain falling on an acre of land amounts to 100 tons of water, and the same fall per square mile would give 60,000 tons. Now an inch of rain falls not very unfrequently at stations on our west coast in the course of a day, so that we can easily see why two or three days' heavy rain cause floods in most of our rivers. The area drained by the Thames is 65 square English miles, or five square geographical miles, as stated by Sir J. Herschel; and accordingly, an inch of rain falling on that district would give us 4,000,000 tons of water, which must almost all

of it drain off the high lands and flood those lying lower before it ultimately finds its way to the sea.

However, the wettest weather with us is almost dry when compared with that experienced between the tropics during the rainy season. Old Dampier, in his "Theory of the Winds," says of the Island of Gorgonia, which lies not far from Panama: "I have been at this isle three times, and always found it very rainy, and the rains very violent. I remember when we touched there in our return from Cape Sharp, we boiled a kettle of chocolate before we cleaned our bark, and having every man his calabash full, we began to sup it off, standing all the while in the rain; but I am confident not a man among us all did clear his dish, for it rained so fast and such great drops fell into our calabashes, that after we had supped off as much chocolate and rain-water together as sufficed us, our calabashes were still above half full."

The heat of the sun is the power that causes the water to rise into the air. It has been very truly said that the world may be considered as a gigantic steam-engine. The fire is the sun, the boiler the sea near the equator, the condenser the cold air of high latitudes like our own, while the work done is the growth of all vegetables and animals.

Let us look a little closer into this, and see how the operation goes on. The action in virtue of which the water rises is called evaporation. Water boils at a certain temperature, but long before it boils steam may be seen rising from the vessel in which the water is being heated. In fact, steam—or, to speak more correctly, aqueous vapour—rises from every free water surface, and even from ice at all temperatures. This steam is not the white thing you see coming out of the funnel of a locomotive, but a perfectly transparent gas. When this is first cooled it forms little drops of water called "bubble steam," and these bubbles floating in the air make an opaque cloud, just as a heap of pounded glass is opaque, although the glass itself may have been quite clear and transparent. The reason is that the light is unequally refracted in passing through the air and the water on the glass, and so the rays cannot get through at all, and the cloud looks opaque.

The best mode of accelerating evaporation is to cause a current of dry air to pass over the surface of the liquid from which the vapour is rising. This is precisely what takes place in the trade-wind zone at all periods of the year, and also in higher latitudes whenever an east wind is blowing. As fast as the vapour is generated it is carried off, being absorbed by the air in its passage, and the place of the partially saturated air is at once taken up by a fresh supply of air, whose absorbing power is as yet unimpaired. Now warm air can contain a much greater quantity of vapour than cold air; and accordingly, as an east wind is always becoming warmer and warmer the nearer it gets to the equator, we see that the trade-winds at the time they reach the limit of the equatorial calms will be nearly quite charged with moisture.

Let us now see what would cause a mass of air so charged to give up its moisture. The simplest answer to this is, if we can cool it, we shall, so to speak, squeeze the water out of it. This cooling may be effected in various ways. The simplest is by causing the air, when charged with moisture, to rise up to a great height in the atmosphere, where it finds a very low temperature prevailing. Every one knows that it is, as a general rule, colder the higher you ascend on a mountain; but balloon ascents have shown us that not unfrequently temperatures extraordinarily low may be met with at no very great distance from the earth's surface. In July, 1850, two gentlemen, MM. Barral and Bixio, ascended from Paris. At a height of 6,000 feet they entered a cloud which enveloped them till they reached the height of 20,000 feet, where the temperature was—9° Fahr., and on ascending 1,000 feet further the temperature fell to—40° Fahr., so that the mercury in their thermometers froze.

Such a change of temperature as this, amounting to upwards of 100°, would be sufficient to render the air, to all intents and purposes, perfectly dry; and as we know that enormous volumes of air do rise at the equator into the higher strata of the atmosphere, a slight calculation will show us how much rain might be produced by this simple action.

A layer of air a foot thick, covering an acre of ground, and possessing a temperature of 80°, as it not unfrequently does close to the line, could contain nearly nine gallons of water. Accordingly, a column five miles high covering the same space, would contain 1,000 tons of water if completely saturated at that high temperature. Now this is not at all an impossible condition for those latitudes, so that, when we take into account the constant motion of the atmosphere, the place of air partially dried being constantly taken by a fresh supply charged with aqueous vapour, the prodigious torrents which pour from the sky in the wet seasons become quite intelligible.

Dampier's account gives a lively impression of what these rains are; and we hear from one observer that the rain in the West Indies falls "not in drops, but in streams of water." These statements are confirmed by accurate measurements made by means of instruments. Capt. Roussin says of Cayenne, that between Feb. 1st and Feb. 24th, 1820, *twelve feet seven inches* of rain fell.

The wettest region on the earth is not, however, Cayenne, or even a district situated between the tropics. This distinction is justly claimed by Cherra Ponjee, in the Cossia Hills, lying north-east of Calcutta. There, in June, 1851, at an elevation of 4,500 feet, 12 feet 3 inches were measured,

while the total annual rainfall is 600 inches, or 50 feet! The average rainfall on our own west coasts is about 30 inches, so that at Cherra Ponjee, twenty times as much falls, and that within the space of about six months. The reason of this unequal distribution of the fall is that when the monsoon changes, and the warm and moist south-west wind is blowing north-eastwards towards Central Asia, it meets a ridge of high land which it must pass over, and in its passage it is chilled, and deposits its burden of water on the western slopes of the hills.

CEPHRENES, THE SECOND PYRAMID.

Of the many wondrous discoveries made by Belzoni, perhaps none was more noteworthy than that of the entrance to Cephrenes, the second of the mighty pyramids of Ghiza—those huge structures that for countless ages have bid defiance to time: vast, solitary, and grand. Seated during his travels at the foot of this second pyramid, Belzoni mused as to the probability of there being an entrance to its interior, arguing that it was highly improbable that such a magnificent structure should have been reared without containing chambers and a means of entrance thereto. He knew that the first pyramid had been explored, but every historical account, from those of Herodotus downward, joined in declaring the second pyramid, at whose foot he mused, to be one huge monumental blank. But Belzoni was of too inquiring a mind to be satisfied, and, carefully examining the exterior, he at length came to the conclusion that there must be a way to the interior, and set himself boldly to the discovery. The first step to be taken was to obtain permission from the Bey, and that accorded, he collected sixty workmen, and set them to break with their hatchets through a heap of débris joined together by the pulverised mortar that had fallen from far up the side of the pyramid, and then been moistened by the heavy night dews.

A long period of toil then followed, ending in the discovery of a cavity in the side, but no means of entrance. Disappointed but not daunted, Belzoni again surveyed the vast sides of the building, and determined to try in another spot, where, after the labour of many days, first one and then another block of granite was uncovered, and at last the entrance to the pyramid reached—a low passage choked up with fallen stones, which required arduous toil to draw them out. But in spite of the opposition and idleness of his Arab labourers, Belzoni persevered, till a passage large enough to admit one of the men was cleared, and soon after, armed with a torch, the traveller stepped in, and began to look for the reward of his thirty days of incessant labour.

His light burned dimly in the gloomy echoing passage leading to the vast solitudes that had not been invaded for perhaps two thousand years, and it was with a strange feeling of awe that this enterprising man passed on, breathing the dust of a vast antiquity, and with lifted torch trying to pierce the gloom. Passage after passage he explored through the huge rock-built structure; peering anxiously forward lest he should be plunged unawares into some deep pit yawning to engulf him; but he passed on in safety till he reached a door, evidently leading into some great chamber, and then, stepping boldly forward, he stood in the centre of the huge building, trying to pierce the darkness around, and gazing wonderingly at this mausoleum of an antiquity so great that human history gives but a poor clue to its age. His steps echoed upon the stony floor, and seemed to die away in strange whisperings from the sides of the great tomb as he eagerly explored it, now with lowered torch, now with it elevated towards the roof, and listened again and again to some sound, to break the death-like stillness of the place.

The contents proved to be a large sarcophagus of granite; but far from satisfied with this result of his research, Belzoni sought on, and explored passage after passage, and echoing gloomy chambers, evidently formed to be the last resting-places of the kings of some ancient dynasty; but the grandeur of this solemn temple of the dead seemed to lie in its vast solidity and massiveness of construction, qualities which have been the admiration of travellers of every country. Oppressed at length by the strange stifling air of the place, Belzoni returned to the light of day once more, but only to recruit himself, and then, better provided with lights, to return through the long passages, and explore once more the many chambers, which brought to his mind visions of the past grandeur of Egypt, and the scenes that had been enacted upon earth when this pyramid was first declared by its architect complete.

WONDERFUL INSECTS.

The scavenger beetle is one of the most useful of all insects, as it really performs the duties indicated by its name. In hot climates they abound in many villages, which are always sweet and clean, and very unlike those that have to trust to the cleanliness of the natives. No sooner are any pieces of offal or excrement dropped than, attracted by the scent, the scavengers are heard coming humming along as fast as their wings will carry them. They roll away the droppings of cattle at once in round pieces, often as large as billiard balls; and when they reach a place fitted by its softness for the deposit of their eggs and the safety of their young, they dig the soil out from beneath the ball till they have quite let it down and

covered it. They then lay their eggs within the mass. While the young grubs are growing, they devour the inside of the ball before coming above ground to begin the world for themselves. The beetles with their gigantic balls look like Atlas with the world on his back; only they go backwards, with their heads down, and push with their hind legs as if a boy should roll a snowball with his legs while standing on his head. Dead birds, lizards, and all sorts of unpleasant things are thus got rid of and made useful to the young of this important little beetle.

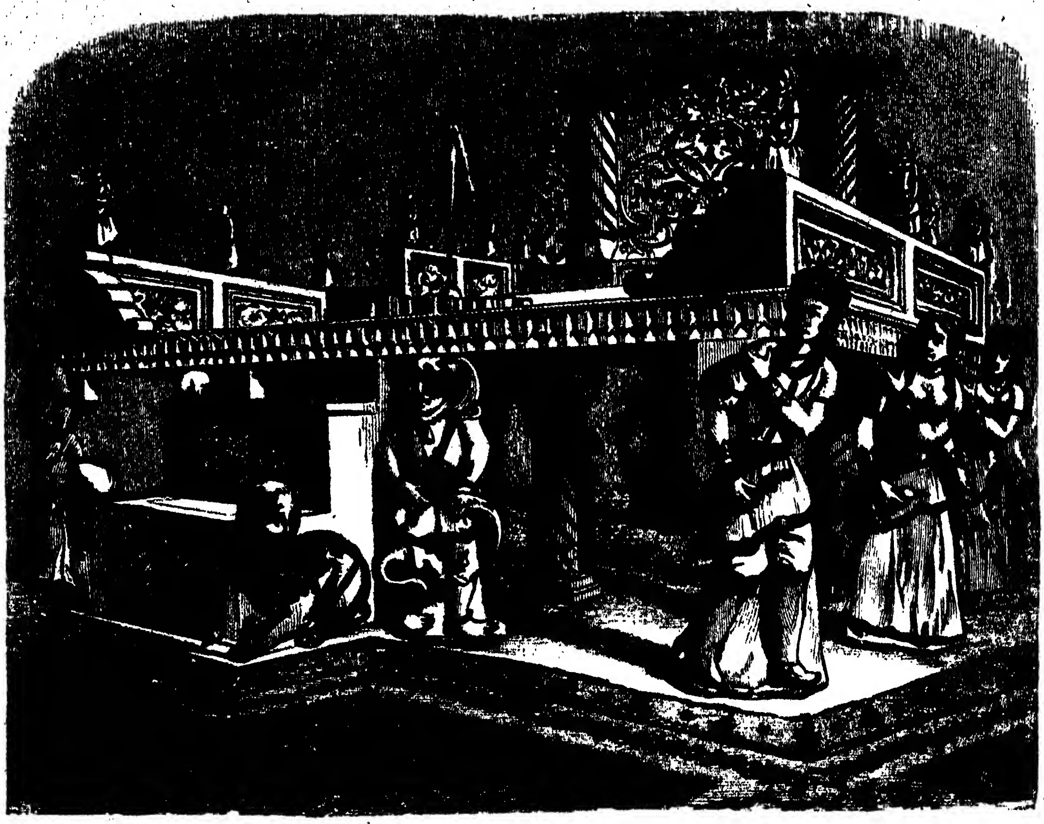
There is a fly in South Africa whose bite is very fatal to oxen, and as these are the drawers of the great wagons of the travellers, this very tiresome insect often prevents very important journeys. The tsetse is not much larger than a common house-fly, and is nearly of the same brown colour as the honey-bee. The after part of the body has three or four yellow bars across it; the wings project beyond this part considerably, and it is remarkably alert, avoiding most dexterously all attempts to capture it with the hand. Its peculiar buzz when once heard can never be forgotten by the traveller whose beasts of burden are domestic animals; for it is well known that the bite of this poisonous insect is certain death to the ox, horse, and dog. In one journey, Livingstone, who was not aware of any great number of the tsetse having alighted on his cattle, lost forty-three fine oxen by its bite. He watched the animals carefully, and did not believe that a score of the flies were ever upon them. A remarkable feature of the bite of the tsetse is its perfect harmlessness to man and wild animals, and even calves so long as they continue to suck the cows. The poison is not inserted by a sting, but by the long proboscis which comes from the mouth. This consists of three blades, the two external being shields to protect the central lancet, which has a poison-bag at its root. The fly simply sticks this into the skin just like a gnat or a gad-fly, and after sucking the blood until its body swells up, it departs. In the case of oxen no immediate effects of the bite come on; but in a few days the eyes and nose begin to run, the coat stares as if the animal were cold, and although it continues to graze it gets thinner and weaker. After a while diarrhœa carries it off. Very often fine cattle in good condition perish soon after the bite from an affection of the brain. All the tissues of the animals become rotten. The mule, ass, and goat do not become poisoned by the sting of the tsetse; and buffaloes, zebras, and antelopes do not suffer more from these pests than from other flies. The tsetse keeps to certain places, otherwise no cattle could exist in South Africa; and although it does not poison the antelopes, yet it sucks their blood and evidently lives upon them. Consequently, when any country infested by the fly has its game driven away, the tsetse die off.

THE TSETSE-FLY AND PROBOSCIS (MAGNIFIED).

Amongst the insects injurious to men, there is one which is better known from its effects than from its peculiar structure. Every now and then in hot summers, people are bitten in England, France, and in Germany by a small fly. A complaint is soon made, for the bite is fierce, and it is usually in a tender spot like the lip or finger. After a few hours the person bitten becomes feverish, and the spot where the bite occurred swells up and becomes very painful and throbbing. The fever continues, and there is great depression of the powers of life; fainting and vomiting come on, and very often severe shivering. The bite, having swollen up to the size of an apple, becomes less painful, but all the veins leading from it look turgid. After from thirty-six to forty-eight hours the unfortunate person dies almost putrid.

Another insect, common in Eastern Africa, is a kind of tick, and it gets between the toes or fingers, for it is not bigger than a pea. It sucks the blood until quite full, and becomes of a dark blue colour. The skin, although very yielding, is so tough that no pressure will destroy the insect. After the bite there are sensations of tingling and itching which gradually ascend the limb; and the pains in the stomach commence and are accompanied with violent vomiting. Recovery is slow under these circumstances, but if these peculiar symptoms do not take place, the poison which produces them gets into the larger veins, and severe and often fatal fever sets in.

In the same district where these ticks live there is a kind of ant, red in colour, very fierce, although small, and which attacks every living thing. It is very fond of meat, and when an ox is slaughtered in the neighbourhood of its nests, fires of straw have to be burned all night around the carcass. They have no fear, and attack with equal ferocity the largest as well as the smallest animals. They are very useful in ridding the country of dead animal matter, and when they visit a hut they clear it completely of the destructive white ants and other vermin. Rats, mice, lizards, and even large snakes surfeited from feeding fall a prey to these tiny but numerous ants. The tsetse and this ant have a great enemy in a large, gaunt, long-legged, hornet-looking fly which is about an inch in length. It is a tiger in its way, for it springs upon the smaller insects, and after sucking their blood throws their bodies aside.



THE THRONE OF THE SHAHS OF PERSIA.

THE THRONE OF THE SHAHS OF PERSIA.

EASTERN potentates have in all ages displayed a magnificence which the sovereigns of the west, notwithstanding their occasional extravagance and taste for splendour, have never attempted to reach. No embellishments were ever too costly to decorate the person and the court of an eastern king. The great empires have long passed away, but in such countries as Persia there may still be seen something of the pomp and ceremonial of former ages. Sir Robert Ker Porter, in the account of his travels in the east, has given us a vivid description of the grandeur which characterises the court of the Shah on state occasions. He pictures the scene on the day of his first presentation, when the ministers, attendants, and favoured visitors were waiting the monarch's entry into the grand reception hall. His sons occupied the positions nearest the throne, the eldest on the right, and the others, according to seniority, on the opposite side. Officers of all kinds stood about the throne in the order of their rank, and the gorgeous attire of the chief persons assembled made the scene already highly impressive.

Sir Robert Porter continues:—"At last the sudden discharge of the swivels, with the clang of trumpets, and I know not what congregation of uproarious sounds besides, announced that his majesty had entered the gate. But the most extraordinary part of the clamour was the appalling roar of two huge elephants, trained for the express purpose of giving this note of the especial movements of the great king. He entered the saloon from the left, and advanced to the front of it with an air and step which belonged entirely to a sovereign. I never before had beheld anything like such perfect majesty; and he seated himself on his throne with the same indescribable, unaffected dignity.

"He was one blaze of jewels, which literally dazzled the sight on first looking at him. A lofty tiara of three elevations was on his head, which shape appears to have been long peculiar to the crown of the great king. It was entirely composed of thickly-set diamonds, pearls, rubies, and emeralds, so exquisitely disposed as to form a mixture of the most beautiful colours in the brilliant light reflected from its surface. Several black feathers, like the heron plume, were intermixed with the resplendent

aigrettes of this truly imperial diadem, whose bending points were finished with pear-formed pearls of an immense size. The vesture was of gold tissue, nearly covered with a similar disposition of jewellery; and crossing the shoulders were two strings of pearls, probably the largest in the world. But for splendour nothing could exceed the broad bracelet round his arms, and the belt which encircled his waist; they actually blazed like fire when the rays of the sun met them.

"The throne was of pure white marble, carpeted with shawls and cloth of gold, on which the king sat in the fashion of his country, his back supported by a large cushion, encased in a network of pearls. The spacious apartment in which it was erected is open in front, and supported by two twisted columns of white marble, fluted with gold. The interior was profusely decorated with carving, gilding, arabesque paintings, and looking-glass, which latter material was interwoven with all other ornaments, gleaming and glittering in every part, from the vaulted roof to the floor.

"While the great king was approaching his throne the whole assembly continued bowing their heads to the ground till he had taken his place. A dead silence then ensued, the whole scene presenting a most magnificent and, indeed, awful appearance. In the midst of this solemn stillness, while all eyes were fixed on the bright object before them, which sat radiant and immovable, a sort of volley of words, bursting at one impulse from the mouths of the mollahs and astrologers, made me start, and interrupted my gaze. This strange oratory was a kind of heraldic enumeration of the great king's titles, dominions, and glorious acts, with an appropriate panegyric on his courage, liberality, and extended dominion."

The throne of the Shahs, depicted in our illustration, is a work of the seventeenth century, having been constructed for Shah Abbas the Great, who held his court at Ispahan. Towards the close of last century, Teheran became the capital, and thither this throne was removed with other treasures. It appears to be kept, however, rather as a memorial of past magnificence than for actual use at the present time, the throne on which the present monarch holds his state, as described by Sir Robert Porter, being of much less elaborate design.

ECCENTRIC MOVEMENT OF THE FIXED STARS.

At a meeting of the Berlin Academy of Sciences, on the 31st of May, 1851, the celebrated Alexander von Humboldt made a very remarkable communication on the subject of some singular movements which had been observed in the fixed stars. In this he related that at Trieste, January 17, 1851, between seven and eight p.m., before the rising of the moon, when the star Sirius was not far from the horizon, it was seen to perform a series of eccentric movements. It rose and sank, moved left and right, and sometimes seemed to move in a curved line. The observers were M. Keune, a student, and M. Thugutt, a sadler, both certified to be reliable persons. The family of the latter also beheld the phenomenon. M. Keune, with his head leaned immovably against a wall, saw Sirius rise in a right line above the roof of a neighbouring house, and immediately again sink out of sight behind it, and then again appear. Its motions were so considerable that for some time the beholders thought it was a lantern suspended by a kite. It also varied in brilliancy, growing alternately brighter and fainter, and now and then being for moments quite invisible, though the sky was perfectly clear. This phenomenon had been remarked twice, but, so far as is known, only twice before, once in 1799, from the Peak of Teneriffe, by Humboldt himself, and again, nearly fifty years later, by a well-informed and very careful observer, Prince Adalbert of Prussia.

THE STATUE OF JUPITER OLYMPIUS.

This colossal statue was the masterpiece of Phidias, who flourished 444 B.C., and was the greatest sculptor of his age. It was executed by him for the people of Elis, and surpassed his celebrated statue of Athené, in the Parthenon. The Jupiter was set up in a temple at Olympia, near Elis, where the Olympic games were celebrated. Pausanias described the statue from personal observation, which Strabo corroborates. The god was formed of gold and ivory, and measured 58 feet in height; he was seated on a throne, and almost touched the roof of the temple. Upon his head was an olive crown; in his right hand he bore a winged figure of Victory, crowned, and holding a wreath. The Jupiter, in his left hand, bore a lofty sceptre surmounted with an eagle. His sandals and robe were of gold, and the latter was painted with animals and flowers, chiefly lilies. The faces of the steps bore bas-reliefs of classic myths, and the footstool rested upon four couchant lions. In this work, Phidias embodied Homer's impersonation of the god.

The heathen historians tell us that Phidias received for his skill the testimony of Jupiter himself. When the artist prayed the god would make known if he was satisfied, immediately the pavement of the temple was struck by lightning; the spot was afterwards marked by a bronze vase. Crowds flocked to Elis to behold this wonder. Nor was the admiration merely the superstition of the multitude; for even a Roman senator, when looking at this statue of ivory and gold, professed to have had his mind moved as though the god

were present. The able restoration of this figure has been learnedly commented on by M. Quatremère de Quincy.

The statue was placed in a Doric temple built of marble. Many of the blocks weigh nearly nine tons each; each of two remaining capitals is computed to weigh more than twenty tons each, and the flutings of the columns would contain a man in their hollowings as in a niche. The pediments were sculptured with the Wars of the Giants, and the Siege of Troy. Upon the entablature stood a row of Atlantes, each twenty-five feet high, and supporting an upper entablature at 110 feet above the floor. The nave of the temple was eighteen feet higher, and two feet broader, than the nave of St. Paul's Cathedral.

THE LOSS OF THE "KENT."

HEAVILY laden with shot and shell, and bearing besides a considerable portion of the 31st Regiment of Foot, with forty-three women, and some sixty or seventy children, the *Kent*, East Indiaman, set sail from England on the 19th of February, 1825, nearly 650 souls on board; but the vessel was fine and new and well officered, and under a brisk breeze she stood down the Channel. But the weather soon grew foul, and on the eleventh day the vessel lay to, labouring heavily in a pitiless storm, the waters thundering against her sides, timbers creaking and groaning, people fresh to the sea helpless and dejected, the women frightened, the children cross and weary; while, worn out with extra work and anxiety, the crew clung about the deck, ready to attend to any new order for easing the pitching and rolling of the huge vessel that wallowed amidst the seething waters.

Officers and men were anxious, for the vessel, heavily laden with military stores, rolled more and more, so that in cabin and hold articles broke loose, dashing from side to side of the vessel, and in consequence, one of the officers descended to the hold to endeavour to secure a cask that was rolling at every plunge of the ship. He had hardly attempted to get it wedged in its place when a heavy lurch made him drop his lantern, and in an instant the cask, which was full of rum, was stove in; the spirit had reached the lantern, and a bright blue flame was darting and flickering about the hold. As noiselessly as possible, attempts were made with bucket and wet sail to extinguish the flames, but in vain, and in a short time the blue spirit flames became livid and fierce; dense pitchy smoke rolled up the hatchway, and the passengers learned that the ship was dangerously on fire. The extreme peril necessitated extreme measures, and Captain Cobb, aided by the colonel and officers of the regiment, was indefatigable in his efforts to check the flames. But the efforts were those almost of despair; the hatchways and lower ports were opened, and the waves rushed in, flooding the ship, but only to make her water-logged, and the flames still fiercely burned, threatening spirit-room and magazine. There seemed, too, now every prospect of the vessel settling down headlong, and between the two perils men and women were seen praying, weeping, calling despairingly upon God for help, while others, old sailors and soldiers, stood calm and unmoved, or sought the powder-magazine, so as to meet instant death when the vessel blew up.

In the agony of the time hope seemed lost to every heart, and in a stolid despair many clung to the sides of the labouring vessel half-choked with the blackened smoke, waiting for the end they believed so nigh; husband and wife bidding farewell, their children at the same time clinging wonderingly to them. The sea rose more fiercely, and the burning vessel was tossed like a cork upon the waters, when a man who had gone aloft, suddenly electrified the crowd below with the shout of "A sail!" Hope once more came to the trembling crew, and the rapidly advancing vessel was watched with straining eyes till she hove-to as near as was safe to the burning vessel. And then the bravery and discipline of the soldiers and sailors were displayed, as in obedience to the orders given, there was an utter absence of crowding and rushing forward, but the boats were lowered, three to be lost, but three to do good duty in the tempestuous sea, bearing away first the women and children, and then soldiers and crew, each man in his turn, although at any moment the magazine might have exploded, or the vessel gone down. And a dangerous task was that of being lowered into the boat—men clinging to the end of the spanker-boom, and then sliding down a rope to try and reach the boat rising and falling on the vast waves—so dangerous a task, that many of the soldiers would not run the risk, but preferred to cling to the last to the burning vessel. Many missed the boat and were lost in the seething waves; but to and fro, hour after hour, the boats toiled, till the little brig that had come to their rescue was densely crowded by those who had so bravely acted their part in the dire struggle; officers remaining to the last, men struggling to save their wives and children, and some leaping overboard with them to swim to the boat.

The last boat-load had put off, leaving those who would not quit the vessel; and as it reached the brig, the *Kent* was seen to be one mass of flames. The towering masts toppled overboard, laden with men who clung to them, and then a bright light darted into the air, the blazing fragments of the vessel shot up, and then for awhile the hull burned like a golden skeleton on the waters, till the crew of another vessel coming up, picked up a few

stragglers clinging to spars in the water. Two or three journeys their boats made, when the flaming hull was seen to roll for a few moments, and then to plunge down, to leave all black and still as the death it had encompassed.

When day broke, two more men were picked up, clinging to the fore-mast; but eighty-one men, women, and children perished in the horrors of that day and night. Meanwhile the brig, laden as she was, and ill-provisioned, sped on homeward with her helpless crew of unfortunates—eighty, closely packed in a cabin intended for ten; but, though the gale blew fiercely, the captain of the little vessel kept up a press of sail, and landed his charge safely at Falmouth. The sufferings had been terrible, but throughout a noble display of self-denial and gallantry had been shown—men willingly risking their own lives again and again to succour the feeble, giving up their own chances of escape to some one more helpless, while in the case of the soldiers discipline was maintained to the last. The whole of the rescue was marked by strange and providential circumstances, for it was only by chance that the brig encountered the burning vessel, since she had but that morning changed her course; while the length of time that the *Kent* kept afloat seemed marvellous, attacked as she was by the two destructive elements, one of which was for hours momentarily expected to reach the magazine.

Wonderful Plants.

NATURAL HYGROMETERS.—The fact that the tissues of plants expand when they are in a moist state and contract when dry has been put to use by employing some plants as indicators of the amount of moisture in the atmosphere. The whole class of sea-weeds are specially suited for this purpose. They are composed of a mass of cells, which very readily absorb water, and the membrane or skin which encloses the substance of the leaves is so delicate that it presents but little obstacle to the passage of the liquid. The long slender frond of the saccharine Laminaria is a favourite weather-teller among the cottagers at the sea-side. In dry weather it is dried up and brittle, while the least moisture tells upon it, and as the moisture increases the leaf enlarges, becomes pliable, and green, and looks as if it had not been long out of its native element. Scientific instrument makers have taken advantage of the same property in making their instruments. Strips of wood, carefully adjusted, firmly fixed at one end, and carrying a pointer at the other and free end, indicate with great accuracy the degree of humidity in the atmosphere by the amount of their expansion. Various woods have been thus employed, and among others, strips of box-wood, the most homogeneous and close-grained wood known, and on this account employed in wood engraving. Substances formed of vegetable tissues are also used as hygrometers, such as strips of paper or pieces of twine. A piece of twine six or eight feet long, the one end fastened to a nail, and the other to a rotating axis, to which a lever index is attached, forms a remarkably sensitive and very good hygrometer. The awn, or long bristle attached to the seed of some species of oats, has singular hygrometric properties, and is on this account sometimes placed along with the thermometer as a part of the furnishing of a complete barometer. The absorption of moisture causes the awn to twist, carrying its free end more or less round the arc of a circle. But the most remarkable examples of such awns occur in the sterile oat, the animal oat of gardeners. The ripe grains are enclosed in hard, hairy, brown husks, from the back of which rises a stout bent and twisted awn. Two of the husks generally grow together, and separate from the straw by a deep oblique scar. The hairy husks have a striking resemblance to the body of a spider, and the oblique scar represents its head, while the two bent awns look like legs. When ripe, the oat falls from the plant, and in warm dry weather rolls and turns about on its long legs, as they twist from their hygrometric property. It is a strange sight to see these animated seeds tumbling and sprawling about in different directions. By-and-bye they become quiet, the heat having twisted the awns till they can twist no further. But their activity is speedily restored if they are sprinkled with water, or when the dew or rain falls, the moisture causing them to untwist and turn about with renewed activity.

THE COMPASS, OR POLAR PLANT.—In the western prairies of the United States there grows a plant which is sometimes of great value to the wanderer in these trackless regions. It grows to the height of from three to six feet, and has a head of yellow flowers somewhat resembling our hawkweed. The peculiar help it renders to the wanderer arises from the fact that the long leaves at the base of the stem, which are placed, not flat on the ground, as in plants generally, but in a vertical position, have a decided tendency to present their edges north and south. Several careful observers testify that this is the case, but it has been somewhat discredited, because of the strong language employed regarding it by some authors, who say that it is "a guide unerring as the magnetic needle," &c. A recent observer gives, in the *American Journal of Science*, the result of an examination of a large number of specimens. "One half of them," he says, "bore within half a point of north, and two-thirds within a point." This curious plant is also called the pilot-plant, and from the quantity of resin which exudes from its stem it is sometimes known as the resin-weed.

ENTRANCE TO THE CAVES OF ELEPHANTA.

Wonders of Construction.

THE CAVES OF ELEPHANTA.

A FEW miles from Bombay, in the harbour of that city, stands the island of Elephanta, which possesses a very remarkable Buddhist temple, dug out of the solid rock or mountain. The island derives its name from the colossal figure of an elephant, also hewn out of the rock, which used to form the most conspicuous object from the principal landing-place, but has now almost entirely disappeared under the gradual influence of wind and weather. The temple itself is also being rapidly affected in the same way, so that in a time, perhaps not very far distant, its chief beauties will have vanished. There is no record of the date of its construction, but, from the fact of its being perceptibly influenced by the causes just mentioned, it is judged that its formation must be assigned to no very remote period. At the time, however, when the temple was in use by the natives, its entrances, which are now decayed, may have been sufficiently substantial and protected to guard against this danger.

The temple consists of four rows of massive columns, which were left standing to support the ceiling when the rock itself was hewn out. Colossal figures adorn the walls, and, from the manifest connection of these figures with the Hindoo religion, the purpose of the temple as a Buddhist place of worship is made evident. The columns form three avenues, by which the most important figure is approached. It represents the triad deity in the Hindoo mythology: Brama, the creator; Vishnu, the preserver; and Siva, the destroyer. The countenances of the first two have a mild aspect; that of the third is marked by severity and revenge. In one hand it holds a cobra di capello, while the hands of the others are occupied with flowers and fruit, the symbol of blessings to mankind.

The total length of the temple is about 220 feet, and its width 150 feet. The height is in no part more than from fourteen to fifteen feet, and, in spite of the impressive character of the columns and figures, the spectator cannot divest himself of the impression that he is really in a cave. From the right and left avenues there are passages to smaller excavations on each side; a pool of water penetrates from one into a cavern far under the rock, but whether this pool is natural or artificial in its origin is not known. A corresponding chamber on the opposite side contains two baths, one elegantly finished, while the chamber itself is ornamented by sculptures different in character from those of the interior of the temple.

The columns convey the idea that they have been pressed by the weight of the mountain into smaller proportions than were originally designed for them, but this is of course an erroneous notion. One third of the total height of each pillar is occupied by the base on which it rests. Although graceful

in form, they are too stunted to be elegant in proportion, but the effect of the entire group in either of the avenues is highly impressive.

"I once," says Mr. Forbes, the celebrated oriental traveller, "accompanied an eminent English artist on his first visit to Elephanta; he had seen the most striking objects of art in Italy and Greece, but never anything which filled his mind with such extraordinary sensations as to the general effect." However these gigantic statues and others of similar form, in the caves of Ellora and Salsette, may astonish a common observer, the man of taste looks in vain for proportion of form and expression of countenance. The Elephanta caves especially cause admiration when we contemplate the immensity of the undertaking, the number of artificers employed, and the extraordinary genius of its first projection, in a country until lately accounted rude and barbarous by the enlightened nations of Europe. It is a work which would be admired by the curious had it been raised from a foundation like other structures; but when we consider it is hewn inch by inch in the hard and solid rock, we cannot but be astonished at the conception and completion of the undertaking.

The illustration given on the preceding page represents the exceedingly picturesque entrance to these wonderful caves; the peculiar shape and sculpture of the capitals being especially noticeable as strikingly characteristic of, and peculiar to eastern architecture.

SOUNDS DURING THE NIGHT.

THE great audibility of sounds during the night is a phenomenon of considerable interest, and one which had been observed even by the ancients. In crowded cities, or in their vicinity, the effect was generally ascribed to the rest of animated beings, while in localities where such an explanation was inapplicable, it was supposed to arise from a favourable direction of the prevailing wind. Baron Humboldt was particularly struck with this phenomenon when he first heard the rushing of the great cataracts of the Orinoco in the plain which surrounds the mission of the Apures. These sounds he regarded as three times louder during the night than during the day.

Some authors ascribed this fact to the cessation of the humming of insects, the singing of birds, and the action of the wind on the leaves of the trees; but Baron Humboldt justly maintains that this cannot be the cause of it on the Orinoco, where the buzz of insects is much louder in the night than in the day, and where the breeze never rises till after sunset. Hence he was led to ascribe the phenomenon to the perfect transparency and uniform density of the air, which can exist only at night after the heat of the ground has been uniformly diffused through the atmosphere. When the rays of the sun have been beating on the ground during the day, currents of hot air of different temperatures, and consequently of different densities, are constantly ascending from the ground and mixing with the cold air above. The air thus ceases to be a uniform medium, and objects seen through it which are very indistinctly visible have a tremulous motion, as if they were "dancing in the air." The very same effect is perceived when we look at objects through spirits and water that are not perfectly mixed, or when we view distant objects over a red-hot poker or over a flame. In all these cases the light suffers refraction in passing from a medium of one density into a medium of a different density, and the refracted rays are constantly changing their direction, as the different currents rise in succession. Analogous effects are produced when sound passes through a mixed medium.—*Sir David Brewster.*

UPTILTED MOUNTAINS.

WHEN the cliffs on the coast of Kent and Sussex are examined, the long lines of flint are seen to be level. One line is over the other, but the lowest is level with the sea, and is said to be horizontal. But if the same kind of cliffs are examined in the Isle of Wight, the lines of flint are either very slanting or else quite upright; they are then called vertical. In the Jura mountains there are parts where large cliffs are quite curved, and the grain of the rock is like the top of a succession of large waves. There must have been a tremendous force to have tilted the chalk in the Isle of Wight from its flat condition up on end, and even a corresponding amount would hardly have bent and crumpled a mountain as in the Jura range.

The beautiful mountain, the Righi, near Lucerne, in Switzerland, was once a great mass of pebbles cemented together, and was a horizontal cliff. A force from below tilted it up on end, and geologists assert that it fell over, and that the top, where visitors now admire the rising sun, was once the bottom. Something of the power of the forces hidden deep down in the globe can be learned when it is noticed that whole continents have been moved upwards inch by inch, and mountains of granite and other stones which originate within the earth are forced up through the soil and underlying rocks to the height of 27,000 feet. In their passage upwards these mountains tilt up the strata on either side, and the formerly flat deposits become vertical, or nearly so. Not only do they tilt the strata, but they lift them up for thousands of feet. Thus sea-shells are found in abundance fossilised ten or eleven thousand feet above the sea level in the Alps.

Wonders of Animal Life.

MIGRATIONS OF INSECTS.—There is a very pretty butterfly called the Painted Lady, which is very common in some parts of England, and it is very celebrated for its swarms, which have been known to pass over great distances. Most insects, and especially moths and butterflies, live exclusively in one country, in some particular island or on part of a continent, but the Painted Lady is common in England, Europe, Asia, and at the Cape of Good Hope, in Southern Africa; moreover, it has been found in Australia, Japan, and America. A vast swarm of these butterflies, forming a column from ten to fifteen feet broad, was seen in 1826, in one of the Swiss cantons. The myriads of beautiful winged creatures flew onwards in regular order from north to south with great rapidity. In the month of March of the same year, a similar swarm was observed, south of Switzerland, flying from north to south, and at night the butterflies alighted and covered the plants and flowers. These insects must have congregated together, in the first instance, from considerable distances, and a common impulse directed them in their flight. These emigrations from one country to another do not occur in the lifetime of every Painted Lady, but only now and then after the lapse of many years. Many insects emigrate pretty regularly from one country to another, and yet live solitary lives until the time for moving commences; then, like the swallows, they collect together by some wonderful instinct, and fly away in enormous multitudes. The lady-birds, the locusts, and the daddy-longlegs, are familiar examples.

THE COCOA-NUT CRAB.—Mr. Darwin, in his "Naturalist's Voyage," thus describes a crab which makes its diet of cocoa-nuts, and which he found on Keeling Island, in the South Seas. "It is very common on all parts of this dry land, and grows to a monstrous size. It has a front pair of legs, terminated by strong and heavy pincers, and the least pair by others which are narrow and weak. It would at first be thought quite impossible for a crab to open a strong cocoa-nut covered with the husk; but M. Liesk assures me he has repeatedly seen the operation effected. The crab begins by tearing the husk, fibre by fibre, and always from that end under which the three eye-holes are situated. When this is completed the crab commences hammering with its heavy claws on one of these eye-holes, till an opening is made; then turning round its body by the aid of its posterior and narrow pair of pincers, it extracts the white albuminous substance. I think this is as curious a case of instinct as ever I heard of, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a cocoa-nut."

TWO-HORNED RHINOCEROS.—M. Casanova has just brought from Nubia to Hamburg one of the two-horned species of rhinoceros, a fine, healthy young animal. It differs much from the Indian rhinoceros; the lower lip is pointed. This rhinoceros has not been seen in Europe alive since the time of the Romans.

THE INDUCTION COIL.

INDUCTION is one of the most interesting features of electricity, and from a general point of view it may be explained as an influence exerted by an electrified body upon one non-electrified—the two bodies *not being allowed to touch each other*. If a glass rod be electrified by friction, and caused to approach a gold-leaf electroscope, the gold leaves will separate, and when the rod is withdrawn they will collapse; but if the rod be allowed to *touch* the cap of the electroscope, the leaves will remain separated after the rod is withdrawn. The action is evidently different in the two cases; in the first the effect is *inductive*, in the second, *transmitted*. Again, when two wires are placed parallel and close to each other *without touching*, every time a current of electricity is passed through one wire, a current or "wave" of electricity is observable in the other. It is generated at the instant the current enters the first wire, and then ceases, and another wave in the opposite direction is produced in the second wire at the instant the current ceases to flow in the first. This "wave" is an inductive effect, and the current so produced is said to be *induced*.

We will notice another instance of induction. If a magnetised steel bar be quickly inserted into a hollow coil of insulated wire, a wave of electricity is produced in the wire, and if the bar be quickly withdrawn a second wave is produced in the opposite direction. These waves are *induced* currents of electricity. An electro-magnet may be employed instead of a permanent magnet with advantage, because the bar of iron can remain inside the coil and be magnetised or de-magnetised without removal. If a bar of soft iron be encircled with an insulated wire, the bar becomes magnetic when a current of electricity traverses the wire, and ceases to be so when the electric current ceases to flow, and by placing this arrangement within a second coil, we induce a wave of electricity in the wire composing it every time we magnetise and de-magnetise the bar. This, then, is the principle of the induction coil. Its arrangement is as follows:—A bundle of iron wires is encircled by a coil of thick insulated copper wire, called the "primary" wire; the bundle being preferred to a solid bar, because it more quickly becomes magnetic. The ends of the primary wire are arranged as in Fig. 1, in which B is the bundle of iron wires, and C the coil of thick wire. One end, A, is

led direct to the battery, and the other end, A′, to a brass cock, to which is fixed by a spring a small disc of iron, D, placed in front of the iron wires, and having a stud of platinum inserted into its centre. The other end of the battery is connected with a pillar of brass, S, through which works a screw with a platinum tip, the screw being allowed to enter far enough to bring its point into contact with the platinum in the disc. When these connections are completed, the battery current flows round the coil, making the enclosed wires magnetic. These immediately attract the disc, D, and in so doing break the battery circuit at the point where the two pieces of platinum touched; the wires being then no longer magnetic, the disc springs back, the circuit is again completed, and the disc again attracted; thus a constant and rapid succession of battery currents traverses the coil; the motion of the disc being so rapid that the vibration of the spring produces a musical note. The object of the primary coil is simply to produce magnetism in the iron core in as sudden a manner as possible. Outside this coil is wound another, consisting of insulated wire, much finer than the primary, and at least a hundred times as long. This is called the "secondary" coil, and has to be wound with very great care, because the electric current which is induced in it is capable of leaping, in the form of a spark, through a space of air greater or less according to the dimensions of the coil. Here, indeed, is a wonderful effect of induction. The battery current traverses the *primary* wire; it is sluggish in character, and may be handled with impunity, and yet it induces in another and totally distinct coil—the secondary—a current so fierce and intense in its nature that if the coil be large its effect upon the human frame is painful, and may be fatal.

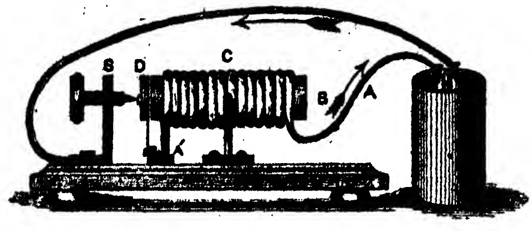


Fig 1.

The intensity of the induced or secondary current is increased by the addition of a piece of apparatus called a "condenser." This, which is shown in Fig. 2, consists of many pieces of tinfoil separated from each other by some thin insulating material. The tinfoil is arranged so that the alternate pieces 1, 3, 5, are connected together at B, and the others, 2, 4, 6, at A. These two sets of foil are then joined into the primary circuit, one upon each side of the platinum points.

Fig. 2.

Fig. 3 shows an induction coil complete with the condenser arrangement, S being the secondary coil wound outside the primary, inside which is the bundle of iron wires B B. The condenser C is usually placed below for convenience, the wires E E leading from it going respectively to D and D′. The extremities of the secondary wire are led to well insulated terminals, one of which is shown at T.

The most powerful coil yet constructed is one made by Mr. Apps for Professor Pepper, and weighs without the battery, three-quarters of a ton. The iron core consists of a bundle of about 2,500 soft iron wires, each as large as a good-sized knitting-needle, five feet long, the entire bundle weighing 123 lbs. Over this is coiled the copper primary wire, rather larger than the iron wires, and more than two miles long. This, with the iron core, is inserted into an ebonite tube, eight feet long and half an inch thick, projecting beyond each end of the coil about eighteen inches, and upon this is wound the secondary wire, also of copper, as thick as a small pin, and 150 *miles* forming a helix four feet two inches long. The eight-foot ebonite tube thus separates the two coils, and, being an excellent non-conductor, it prevents any of the electricity induced in the fine wire coil from leaking into the primary wire. The whole is encased in an outer tube of ebonite weighing 477 lbs.

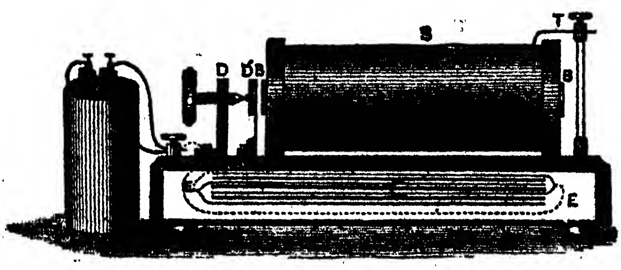


Fig. 3.

The condenser exposes a surface of 375 square feet. The length of the spark varies with the amount of battery power employed; with the highest power yet tried it exceeds *two feet*.

THE RICE-PAPER PLANT.

It is only within a very few years that the true nature has been ascertained of the beautifully smooth and uniform, though very brittle, paper so largely used by the Chinese for drawings of birds, butterflies, and other objects of natural history. It received its popular name of rice-paper from an erroneous notion that it was made in some way from rice. It is, however, the pith of a plant not very distantly related to our common ivy, though having a very different appearance. The plant is called by the Chinese Tung-tsau (hollow plant). It grows wild in great abundance on the hills in the northern districts of the island of Formosa, where it is gathered by the natives, and exchanged on the coast for Chinese produce. It is a small tree, at first growing with a simple stem; after flowering, two or more branches are produced, and the tree increases in size until it reaches a height of twenty or thirty feet; but as the pith deteriorates in the parts of the tree that have become old, it is generally cut down before it is twelve feet high. The large, sycamore-like leaves crown the slender stem, and, when in flower, are surmounted by several wand-like bunches of small, pale-yellowish flowers. A single flower is very insignificant, but the great number of them borne on thin whitish stalks have a striking and beautiful effect, especially from the great contrast between them and the crown of large dark green leaves. The stem is strongly marked by the transverse scars formed by the fallen leaves. It is covered by a thickish bark, and the wood is hard, heavy, and durable.

THE CHINESE RICE-PAPER PLANT (*Tetrapanax papyrifera*).
[The figure represents the method of preparing the paper.]

The collectors cut the stems into lengths of nine or twelve inches. The pith is about two inches in diameter, and is very uniform in texture, except in the centre, where it is broken into a series of doubly concave cavities. A straight stick is inserted into the end of each piece, and the pith is forced out at the other end by hammering on the ground. The pith is then placed in hollow bamboos, where it swells to its natural bulk and dries straight. The pith is then dexterously cut by workmen, who hold against the cylinder a long sharp knife, which is kept quite steady while the pith is moved round and round. The paring thus goes on continuously until the inner broken pith is reached. Each cylinder produces a smooth, continuous scroll about four feet long. The sheets as they are cut are placed one on the other, then pressed and cut into squares of the required size. These are about three inches and a quarter square, and are sold in packets of 100 each at rather less than one penny the packet. The small squares are dyed different colours, and made into artificial flowers for ornamenting the hair of the Chinese ladies.

Large piths occur in other plants besides the Tung-tsau. An Indian plant named Shola, belonging

to the Leguminous or pea tribe, was by many believed to be the source of the rice-paper. It is extensively employed in Singapore for the manufacture of floats and buoys for fishermen, and for the light sun-hats worn in the east: but it is greatly inferior in colour and quality to the true rice-paper. The Taccada, an erect shrub growing on the shores of India and Ceylon, has a pith of considerable size, and of a firm, white appearance. It is much used by the Malays and Siamese for making artificial flowers, small figures, and other articles used as decorations at feasts and on festivals. Among British plants the elder tree has a very large pith, which has not, however, been applied to any practical use. It can be readily pushed out of the stem in the same way by which the Chinese get the pith of the Tung-tsau. The hollow stems that remain have given to the tree its popular name of bore tree.

THE BOX TUNNEL.

THE Box Tunnel, upon the Great Western Railway, is a triumph of engineering skill. It is 9,680 feet long, and, being constructed for the broad gauge, is wider than usual. It is thirty-five feet wide and thirty-nine feet high; it contains thirteen shafts, originally constructed to facilitate the excavation of the tunnel, but now employed for ventilation. The lowest of these shafts is eighty feet high, and the highest 306 feet.

Four hundred and fourteen thousand cubic yards of earth and rock were taken out of the tunnel, and 30,000,000 bricks were employed to line its sides, although in many places the rock is sufficiently hard and compact to stand by itself. It required two and a-half years to complete the work, and for every week during that period one ton of gunpowder and one ton of candles were consumed in it. The rock is freestone. Eleven hundred men and 250 horses were at work incessantly upon the excavation, and it is said that as many as 100 men were killed during the progress of the work.

Upon one occasion the water poured in with such violence from some hidden cavity or subterranean lake that, in spite of the ordinary pumping appliances in use, it filled the uncompleted tunnel, and rose fifty-six feet in the adjoining shaft. An extra pumping-engine of fifty-horse power was at length brought into action, and this, which discharged at the rate of 32,000 hogsheads a day, at last kept the water down. The tunnel inclines towards Bristol at the rate of one foot in 600; the London end is, therefore, sixteen feet higher than the other extremity.

A remarkable fact in connection with this tunnel is, that upon two days in the year, provided the tunnel be free from steam and smoke, the setting sun throws its beams completely through it.

GAD-FLIES.

IF on a fine hot summer day the caterpillar which eats away all the leaves of the gooseberry bushes, leaving the stalks sticking up, is watched, a very small black fly with a very long body, a sharp-looking tail, and long wings, will be often seen hovering about. This fly moves quickly, and finally sees the plump caterpillar. It rushes at it like a tiger, and pokes its tail under the skin of the unfortunate gooseberry-leaf eater. From that moment the caterpillar has a small egg under its skin which soon becomes a grub. The grub lives on the juices of the wretched caterpillar, and when it dies comes forth ready to attack the next generation of gooseberry-leaf eaters.

Now the same sort of occurrence has rendered the gad-fly an intolerable nuisance to horses and cattle. Nearly every quadruped, whether wild or tame, has a special gad-fly. In June or July swarms of the *Œstrus ovis*, or sheep gad-fly, occasionally attack flocks, and the sheep have the instinct to put all their heads together and lie down on the ground. But if the fly has the opportunity, it darts at the sheep's nose, and passing just inside lays a small egg. The warmth and moisture soon hatch it, and a little worm escapes and crawls upwards into some of the folds of the membrane of the nose. The sheep gallops furiously about, snorting violently and almost mad. But the worm moves about until it has found a snug spot, and then, digging the two hooks with which it is provided into the fine membrane of the nose, it remains quiet until April or May in the next year. Then, having grown to its full size, the grub crawls down the nose again, giving the sheep great pain, and drops at last on to the ground. It then burrows in the soil, becomes a chrysalis, and after a month or two emerges as a fly, ready for mischief.

The gad-fly of the ox is the largest, and chooses a nice plump young ox, and alighting on its back like any other fly, close to the back-bone, it pierces the hide and lays an egg in the fine fat. The ox darts away bellowing, and if there are others near, they know what has happened, and rush away either into the bushes or into the water, where the fly cannot follow. A small swelling forms over the so-called bite, and if it is cut open a small white worm is seen. It lives on the fat, and grows until the next year. Then it has to eat its way out of the skin, and when it has done so there are plenty of starlings and other birds ready to devour it. But if it falls safely to the ground it burrows, and after living as a chrysalis, turns to the perfect fly in August.

The gad-fly of the horse has a still more wonderful life. It is often seen late in the summer very busy about horses, and, if watched will be

observed to dart suddenly upon some part of the hair which the horse is in the habit of licking. The fly balances itself for a moment and then deposits an egg on one of the hairs, and fixes it by a gummy secretion. Perhaps fifty or a hundred eggs are thus laid, and then the fly dies. If a horse at grass is examined in August hundreds of these eggs may be found on its legs and shoulders. In two or three days the eggs are ready to be hatched. Possibly the horse feels the stiffness of the hairs on which they are stuck, and licks the part. The warmth of the tongue and the moisture dissolve the egg, and a tiny worm escapes into the horse's mouth. It is carried into the stomach with the food, and gives no pain to the horse. When in the stomach it fixes itself to the coats by means of a set of hooks, and scoops out a little hole into which its head is plunged; and there it remains until the early part of the summer of the following year, feeding on the secretions of the stomach. It becomes an inch in length, breaks off from its hooks, and passes out with the dung. Once on the ground the grub digs down, becomes a chrysalis, and in a few weeks changes into a perfect gad-fly.

CYCLONES.

CYCLONE is the name given to a revolving storm of wind anywhere, but practice has appropriated this title to storms of this kind occurring in the east. The same phenomenon in the western world is called, if on a large scale "hurricane," if on a smaller scale "pampero," or "tornado."

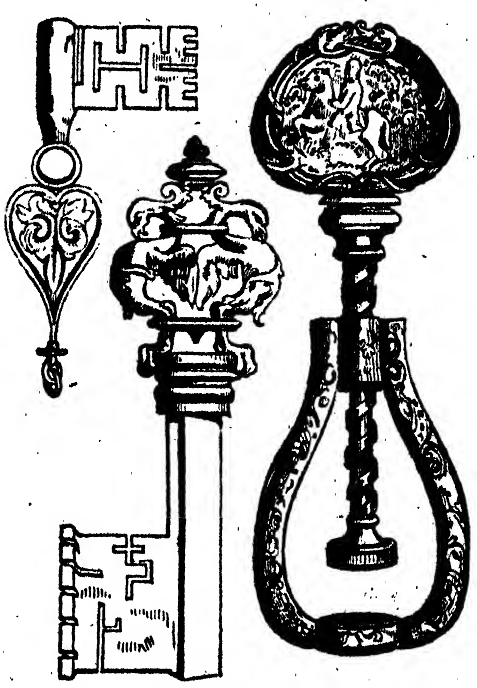
A revolving storm is simply this:—A stratum of hot air, made hot by contact with the hot earth, and by the power of the sun, is overlaid by a stratum of cold air. From the greater weight of the cold air the natural tendency of the hot air to rise is restrained; some cause, local or general, forces an intermixture of the two strata at a particular point, and establishes the nucleus of the storm. The intermingling of the unwilling elements gives rise to considerable atmospheric disturbance, and the particles of air rubbing against one another get whirled round in a direction suggested by the motion of the earth at the place of disturbance; the example set is followed by adjacent blocks of air; and great bodies of wind, co-extensive with the masses of hot and cold air, are set in motion, taking their revolving rate and direction from the heat or nucleus of the storm. The storm acquires strength in rolling, until the whole attains a circular velocity in severe hurricanes of 100 miles an hour. But the storm travels, that is to say it has two motions, its own circular motion at the rate just mentioned, and also the direct motion of the wind prevailing outside its circumference at the time. The whole body of the storm is moved along, still gyrating, at the rate of the general wind, and is borne in whatever direction that wind may be going. In the West Indies hurricanes almost always begin from some point eastward of Barbadoes, whence they proceed in a north-westerly course till the resistance of the land and their own exhaustion cause them to flag. Their track is marked by ravages the most terrible and desolating it is possible to imagine. The great hurricane which swept the West Indies in August, 1831, destroyed, in the space of seven hours, in Barbadoes alone, no less than 1,477 persons, and many thousands of pounds' worth of property; it carried destruction the most complete along a course of 2,500 miles, and was not checked till it had made its way some distance inland on the continent of America. Trees of seventy feet in height were uprooted, houses were blown down as if made of cardboard, men were blown through the air to some distance, and guns in the forts were dismounted and flung down many yards away from where their carriages stood. The tremendous force of the wind piled up the waters so that they stood in a heap in Carlisle Bay, and ships that had been anchored half a mile from the landing-place were floated and driven half a mile inland to be put down in cane fields, or in what had been cocoa-nut groves. Storms of some violence are not unfrequent in the West Indies, but hurricanes of great fury are specially remembered, and people take them for chronological guides, speaking of what happened in such a year after "the wind."

The premonitory signs of a hurricane are a stifling heat, a lurid appearance in the sky, fitful puffs of wind, a sickly look about the sun, moon, and stars; sometimes an atmospheric condition that makes all light-coloured objects look blue, and a falling barometer; the last being the surest sign of all. There are certain months called "hurricane months," viz., August, September, and October, during which revolving storms may be expected, and so reasonably expected that underwriters have made a practice of charging a higher rate of insurance for ships going to or returning from the West Indies during those periods than at other times.

One remarkable fact in connection with these circle-going storms is the shifts of wind which occur at the places over which they pass. The wind that has been blowing furiously from south-west suddenly drops, there is a treacherous lull for a few minutes, and then, just as the inexperienced in such things fancy that the tyranny is overpast there comes a dreadful blast from the north-east, with power equal to that which so lately made signs of giving up its wild sport. A cross sea is set up, in which it is scarcely possible for a ship to live, and in the trough of which, if she be allowed to fall into it, she must inevitably be drowned.

CURIOUS LOCKS AND KEYS.

THE antiquity of locks and keys testifies to the insecurity which has prevailed among mankind from the earliest ages of the world, as proved by the discovery of an actual wooden lock of Egyptian manufacture. Mr. J. Chubb states this to be the most ancient lock of whose form and construction there is any certain knowledge, and which has been in use upwards of 4,000 years. When the French invaded Egypt, at the beginning of the present century, they found among the ruins around the catacombs this lock, very ingenious in its construction, which was as follows:—A staple was fixed to the side of the door, a bolt at a right angle with it, three loose pins in the upper part of the staple, dropping into three consecutive holes, so as to fasten the door when the bolt was pushed to its full extent. The key, a straight piece of wood, having at one end three pegs, corresponding in position with the movable pins or tumblers in the lock, was inserted lengthwise through the shot or hole formed in the bolt; and then the pegs in the key corresponding with the vertical holes in the bolt into which the movable pins of the lock had dropped, lifted up the said pins flush with the top side of the bolt, thus disengaging the movable pins, and allowing it to be moved backward and forward, fastening or unfastening the lock. No key but that which was made for it could open the lock, because from the movable pins being of different lengths, the pegs in the key must be of corresponding lengths, or they would not free the bolt.



ANCIENT KEYS.

The evidence of the antiquity of this lock is chiefly derived from the figure of one sculptured upon the great temple of Karnac. By this it was proved that during forty centuries the lock had undergone no sensible alteration, and this lock was satisfactorily shown to be the foundation upon which most of the ingenious inventions of late years have been based, differing only in the forms of the movable obstructions of the bolts, some of which act vertically, others horizontally; some with a rotatory motion, and many others in an endless variety of ways; in short, the patent locks of our time are but an adjustment of the principles exhibited in the old wooden locks of the land of the Pharaohs.

Metal locks were in use at an early period. The illustration on the opposite page shows an Arabian padlock, and is remarkable as a specimen of Arabic art, and for mechanical ingenuity. The key is held in a horizontal position, and is introduced into the lock at the aperture A; its point, marked A also, entering first. A bar of iron placed behind the outer plate enters the ward of the key as far as B; the key is then raised so as to make it pass the elevated parts indicated by C. A pressure is then exerted upon the springs in the interior, the ends of which are visible at B and D; the upper ward is allowed to rise, and the curved bolt is withdrawn from its sheaths.

Locks were very well known in the east at a very early period. There is an allusion to the common wooden lock in the Book of Nehemiah, and in Solomon's Song.

Some of the ancient keys appear to have been made in the shape of a sickle, and not being easily carried in the hand, were borne on the shoulders as reapers carry their sickles. Mr. Syer Cuming, the archæologist, has ably illustrated the history of keys. We have mentioned the primitive wooden locks and keys of the ancient Egyptians. Mr. Cuming describes the iron keys of Egypt by examples from Thebes, and points out the curious fact that nearly similar specimens are met with in Western Africa. After a brief notice of Greek keys, attention is directed to the Roman era, and a minute description given of the fixed and movable locks, the dentated, piped, and broached keys, and of the variously formed bows surmounting the stems. Small keys were attached to finger-rings, and the Roman housebreaker had his false or skeleton key. The Anglo-Saxon and the Norman keys were of various forms and fashions. There was a superstitious belief in the magical powers of the key, of its employment as an heraldic bearing, and it was frequently adopted as a sign in former times, being frequently used by the apothecary.

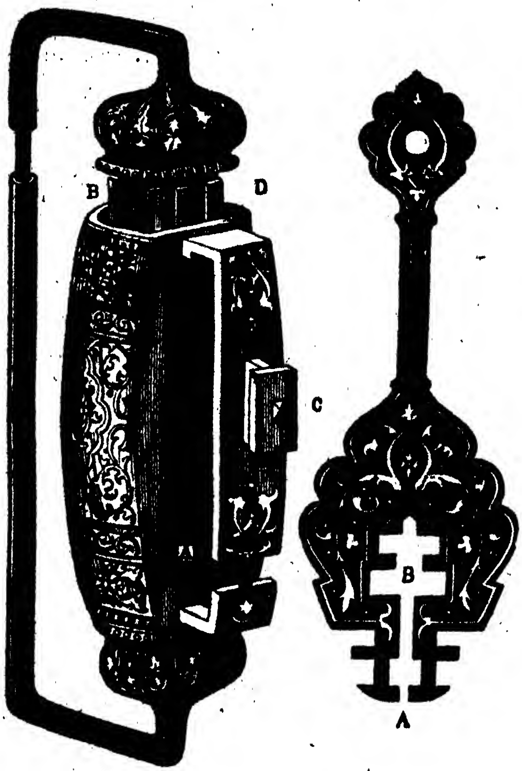
The latch-key has been found at Salisbury with other keys, at least as old as the fifteenth century. The two specimens of antique metal keys are engraved chiefly on account of the elegance of their ornamentation.

A ring for holding keys together appears to have been the earliest as well as the best contrivance for the purpose. Two objects were frequently found appended to the keys of the doors of stables and cow-houses, namely a perforated flint and horn, the former of which was declared to be an amulet to guard the creatures from the attacks of nightmare; and the latter an emblem of Pan, the protector of cattle, and hence regarded as a charm.

It has been proved that in a patent lock, with an averaged sized key having six steps, each capable of being reduced in height twenty times, the number of changes will be 86,400; further, that as the drill-pins and the pipes of the keys may be made of three different sizes, the total number of changes would be 2,592,600. In keys of the smallest size the total number would be 648,000, whilst in those of the largest size it would be increased to 7,776,000 changes.

A wooden Chinese lock, in the possession of Mr. Chubb—which is very superior to the Egyptian, and in fact is founded on exactly the same principle as the modern Bramah lock—long enjoyed the reputation of being the most secure lock ever invented; for it has sliders, or tumblers, of different lengths, and cannot be opened unless they are all raised just to the proper height. It is said that until about ninety years ago, we had no lock so good as this in England.

The security of Bramah's locks depends on the doctrine of combinations, or multiplication of numbers into each other, which is known to increase in the most rapid proportion. A lock of five slides admits of 3,000 variations, while one of eight will have no less than 1,935,360 changes; or in other words, that number of attempts at making a key, or picking it, may be made before it can be opened.



ARABIAN PADLOCK.

POISONOUS EXHALATIONS

FORMERLY there used to be a very curious but cruel exhibition in Italy. There is a cave in the volcanic region of Naples which can be explored by men safely, but on dogs it has a very different effect. When visitors came to the cave's mouth, an attendant would bring a dog in his arms that looked very miserable and was in great fear. The creature was simply put down on its legs in the cave, and after running about for a few seconds, it would fall down apparently dead. It was then taken out, and it soon recovered. But if allowed to remain in the cave, another dog had to be obtained, for death would be found to have claimed the miserable cur. In the island of Java there are some pretty dells and circular valleys where trees and shrubs grow vigorously; but woe be to the man or beast that steps many feet down into them. A sensation of suffocation commences, and unless the traveller has the nerve to turn and rush out of the fatal place death is sure to ensue. Tigers in abundance, deer and cattle leave their bones on the surface as a warning to men, but at night they cannot be seen, and many lose their lives. The same cause produces the death of the dog in Italy and of the men and animals in Java. The circular valley was once the top of an active volcano, and the cave is close to an extinct burning mountain. In either case a gas called carbonic acid gas filters up through the soil. It is heavier than air, and consequently it cannot rise, but forms a layer just above the ground; the dog is so close to the ground that when he is put down, the gas speedily chokes him. In the instance of the basin-shaped valley, the gas rises up far towards the edges, and there may be a depth of sixteen or twenty feet of it in the centre.

When a close charcoal stove is placed in a room, and the windows and chimney are stopped up, this gas is formed, and being heavy rests on the floor

As it gradually rises, anybody sleeping in the room becomes covered with it, and death ensues. The same kind of gas collects at the bottom of old wells, and in brewers' vats. A candle will not keep burning in it, so the workmen always send one down, and if it goes out it is clear that there is too much of the vapour present for them to venture with safety.

When carbonate of soda or chalk are mixed with water and a strong acid, this gas is set free; and effervescing soda always contains it. Water takes a good deal of it into its bulk, and when charged, as it is termed, with the gas, can dissolve large quantities of hard rocks. It is a colourless gas without any smell, but is heavier than air.

THE MANUFACTURE OF BANK-NOTES.

About the year 1819 a great outcry was raised against the Bank of England for not adopting a style of note which could not be imitated, so as to prevent the sad sacrifice of life which at this period was too common, the punishment for forgery being death. The subject at last became so pressing that the government appointed commissioners to investigate the causes of the numerous forgeries, and whether a mode could be devised whereby the forging of bank-notes might be prevented. Previous to this investigation the directors of the Bank had been endeavouring to remedy the evil, many plans having been submitted to them, all of which they were obliged to reject. At one time they were about to adopt a curious and very costly machine for printing the note on both sides so exactly alike as to appear one impression, when a workman came forward and showed that the same thing might be done by the simple contrivance of two plates connected by a hinge. The Bank placed before the commissioners a hundred and eighty different projects which had been recommended for their adoption, and seventy varieties of paper made at their manufactory by way of experiment, in which almost every alteration recommended for adoption had been tried.

The result of this laborious investigation was the bank-note of the present day. The colour of the paper is peculiar, and cannot exactly be imitated by a forger except at great expense. The combined thinness and strength of the paper are also unique. The paper is made in pieces large enough for two notes; each note before it is sized weighs about eighteen grains, and if then doubled it is strong enough to suspend a weight of thirty-six pounds. The texture of the paper is also peculiar; it has a crisp feel, invariably the same, and such that bank clerks of experience can readily detect forgeries by this test alone. Then the wire mark, impressed in the making by a frame, costly to make and difficult to use, is practically inimitable. Each note has thin rough edges, uncut, not to be produced by any mode of cutting paper that is not made expressly for the purpose. The paper for printing is damped with water in the exhausted receiver of an air-pump. The ink used in the plate-printing is made of Frankfort black, which is composed of the charcoal of the tendrils and husks of the German grape ground with linseed oil. This ink has a peculiar and very deep shade of black, common black inks being tinted either with blue or brown.—*From Lawson's "History of Banking."*

Wonders of Science.

Wonders Revealed by Modern Science.—"What mere assertion," says Sir John Herschel, "will make any one believe that in one second of time, in one beat of the pendulum of a clock, a ray of light travels over 192,000 miles, and would therefore perform the tour of the world in about the same time that it requires to wink with our eyelids, and in much less than a swift runner occupies in taking a single stride? What mortal can be made to believe without demonstration that the sun is almost a million times larger than the earth? and that, although so remote from us that a cannon ball shot directly towards it, and maintaining its full speed, would be twenty years in reaching it, it yet affects the earth by its attraction in an inappreciable instant of time? Who would not ask for demonstration when told that a gnat's wing, in its ordinary flight, beats many hundreds of times in a second, or that there exist animated and regularly organised beings, many thousands of whose bodies, laid close together, would not extend an inch?"

Density of Bodies at Different Depths.—Professor Leslie observes that air compressed into the fiftieth part of its volume has its elasticity fifty times augmented; if it continue to contract at that rate it would, from its own incumbent weight, acquire the density of water at the depth of thirty-four miles. But water itself would have its density doubled at the depth of ninety-three miles, and would attain the density of quicksilver at the depth of 362 miles. In descending, therefore, towards the centre of the earth, through nearly 4,000 miles, the condensation of ordinary substances would surpass the utmost powers of conception. Dr. Young says that steel would be compressed into one-fourth, and stone into one-eighth, of its bulk at the earth's centre. However, we are yet ignorant of the laws of compression of solid bodies beyond a certain limit, though, from the experiments of Mr. Perkins, they appear to be capable of a greater degree of compression than has been generally imagined.—*Mrs. Somerville.*

Gun Cotton has been prepared in the United States by treating newly-prepared gun-cotton with

a saturated solution of chlorate of potash. A pistol loaded with one grain of this cotton has sent a ball through a yellow pine door one inch thick, at the distance of twenty feet.

INSIDE OF THE WORLD.

There is abundant scope for speculative philosophers in the matter of the condition of the interior of the globe, and there are a few facts which will assist any one in gaining an idea of the impossibility of ever obtaining a correct notion on the subject. The crust of the earth, as far as is known to geologists, consists of the oceans and continents, with their seas and islands. The highest mountain may perhaps be nearly 30,000 feet, but it is not larger than a grain of sand on a globe three feet across, and the deepest sea would be a very slight depression on the outside. If all the mountains and hills were levelled, and the whole of the land made flat, it would be 1,000 feet above the level of the sea. But if all the deep oceans, shallow seas, and lakes were upon a level bottom, the water of the earth would just be fifteen times deeper than the land is high. There would be 1,000 feet of dry land, and 15,000 feet deep of water. But there is part of the crust under the water, and some seas cover beds of earth which are visible elsewhere on dry land. For instance, the English Channel has much chalk beneath it; and the chalk of Kent, which has been raised above the sea level, has many other beds of earth below it, such as green sand and gault clay. The whole thickness of the crust of the earth under the oceans, of these and of the land, can be estimated within a slight amount, for in many places the different beds of the earth—the chalk, sands, oolite layers, the lias, the coal formation, and the rocks beneath have been tilted from their original flat position upwards and sideways, so that we do not now walk upon the upper surface, but upon the edges or thickness of the strata. Every mile thus walked over is a mile of depth. By adding the depth of one set of tilted strata to others, the depth of about twenty miles is calculated. The lowest of the tilted beds or strata is well seen in Canada, and geologists call them the Laurentian strata; but they are formed of sediments, rolled stones, and limestones, and these must have come from the wearing down of still older mountains and shores; so that there are strata still deeper in the crust of the earth of which nothing is known.

When a thermometer is taken down very deep mines, and the temperature or heat of the top is noticed first of all, it will be found that as a rule the heat increases one degree for every fifty feet of depth. The deep wells of Grenelle, near Paris, which reach down 1,800 feet, are much hotter at the bottom than at the surface. Their heat increases one degree in every sixty feet of depth. If the heat went on increasing at this rate, water would boil at two miles deep, and at thirty-four miles deep iron would melt. In many parts of the world springs come up to the surface whose water is boiling; and it must be remembered that he great agent in all volcanic eruptions is steam, and that the lava thrown out is nothing more than solid rock dissolved at a great depth in the earth by steam pent up and intensely hot. In one eruption Mount Hecla, in Iceland, threw up lava in such quantities that the whole bulk of it must have been as large as the highest mountain in Europe. There must be, then, great lakes where the steam collects in the crust of the earth, so low down that the heat is enough to melt iron, and they must communicate with the volcanoes. When one volcano is in eruption, either the nearest to it are quieter than usual, or else all are belching forth steam and lava; and this proves that the hot lakes have a great extent under the earth's surface, and that they communicate with each other. Now, what can be the state of the inside of the globe lower down than these lakes? Is it all solid or fluid? Mathematicians have proved that our globe is five times heavier than it would be if it were all made of water; but many of the rocks are so formed that if the globe were made entirely of them, it would only weigh three times heavier. If the globe were all made of iron, it would be seven times heavier than the globe of water; and if it were made up of some other metals, it would even be twenty-one times heavier.

From this it is considered that as the centre of the earth is reached, the part under the crust cannot be fluid, for the pressure of such thousands of miles of substances one upon the other would make every fluid a solid. Water, if it reached down only 362 miles, would be like quicksilver, and steel would be compressed into one fourth of its bulk at the centre of the globe. But the heat down there may counteract the effects of pressure, and the kernel of the globe may be a glowing fluid mass. A great philosopher—Mr. Hopkins, of Cambridge—calculated that the solid crust of the earth was 800 to 1,000 miles thick, and that the rest was a liquid. In this crust he supposed the lakes just mentioned to be. He based his calculations on the following facts. Everybody knows that the sun attracts the earth, and the earth the moon, and this great body attracts the earth in return to a certain extent, for it draws the water more or less towards it, and produces the tides in the sea. Our globe is not quite globular, but is slightly flattened at the top and bottom—the North and South Poles—and it bulges out in the middle all round: its shape is something like that of an orange. Now this bulging is nearer the sun and the moon than the rest of the globe, and Mr. Hopkins considered that their attraction would be different if the centre of the world was

fluid and not solid. The denser the substance the greater the attraction.

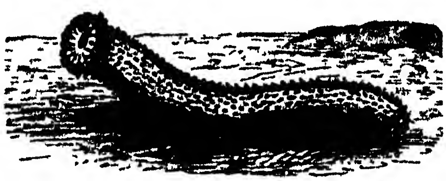
It is, then, a reasonable supposition that the crust of the earth is made up of mountains, land, oceans, and flowing waters, sediments of old rocks, and vast lakes containing molten rocks communicating with volcanoes; that it forms but a small portion of the globe; and that all the rest is made up of a mass consisting of a vast number of metals and gas intensely hot and submitted to enormous pressure. This globe, five times heavier than water, and so hot within, is absolutely covered with eternal ice and snow at its poles, and the only proofs most of us have of the heat within are from hot springs and volcanic eruptions.

There must have been a time when the globe, generally speaking, was hotter than it is now, because as it rolls along it gives off some heat to space; and if this be true, at some time, long ages since, the whole world glowed with heat like any of those great meteorites that are often seen far off, and as the smaller shooting stars do that come closer to us. What may be the future destiny of the world is a question pregnant with interest. There are small bodies revolving round the sun that seem once to have formed a large one; and certainly, if ever a great crack were to open out in the crust of the globe, and the ocean should rush down, such an evolution of steam and explosive gases would result as would break up the world into thousands of pieces.

SEA-CUCUMBERS.

THE sea-cucumbers, or as they are known in the scientific world, the *holothuria*, are extraordinary looking creatures, which vary in size from two or three inches in length, to more than a yard. They bear some resemblance to a cucumber, being a long worm-like cylinder open at one end. Their exterior is ruffled with little projections, which are usually armed with minute sharp hooks, by which the animal can hang on to foreign bodies for a few seconds.

Many of the species are able to produce from their external pores a most irritating fluid, which causes the hand that touches them to itch intolerably. But the creature possesses a most wonderful power: when from any cause it fears death, it can eject all its teeth, its stomach, its digestive apparatus, and reduce itself to a simple membraneous sac. Dr. Johnston kept one of these animals in an aquarium; for some reason or other he neglected to feed it, and when after some days he visited it, he found all its internal apparatus thrown out on the floor of the vessel, and the holothuria itself was a shrunken, dilapidated, and empty tube. Yet it was alive, and in three months had reproduced all its organs anew. Another singular property they possess is that of being able to divide themselves into two parts, each part becoming a separate creature. When this phenomenon is in progress, the middle of the animal begins to contract, and the extremities enlarge. This goes on until the centre is but a thread; at last it snaps, and forms two distinct creatures, which in time furnish themselves with all the necessary organs. Our fishermen throw away the sea-cucumbers, which are sometimes brought up in their nets, and the South-Sea Islanders cannot even look upon them without loathing. But this is not universally the case. The Chinese relish them greatly, and "trepang," as they call the holothuria, forms a very prominent article in all the Chinese markets. The great trepang fishers are the Malays. The expertness with which they capture the creatures is marvellous. By long experience they can see a trepang at a depth of thirty yards. They then poise a harpoon made of a long bamboo, and seldom or never miss their aim. To prepare it, the fish is boiled, then beaten flat with stones, and finally dried in the sun. It is said that a soup can be made with it, little if at all inferior to that made from the turtle.



THE SEA CUCUMBER.

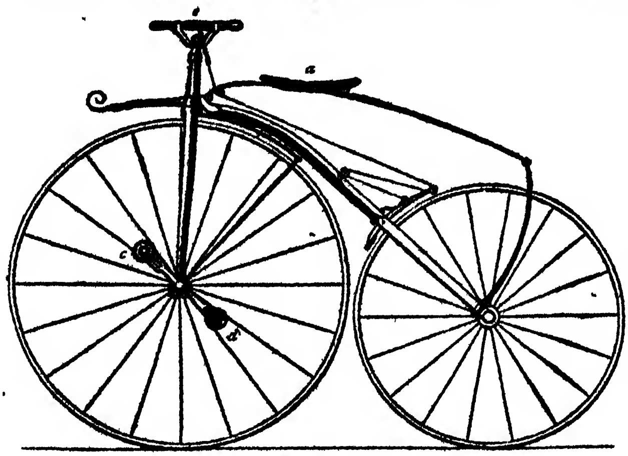
The *synapta*, a peculiar genus of the holothurias, is a native of the English Channel. It is a beautiful creature, a cylinder of which seems as if it were made of rose-coloured crystal, and passing through this tube appear five narrow ribbons of white silk, which mingling together form the head. The tissues are finer than the thinnest gauze; and yet this creature lives on a sandy bottom, and it is gorged from one end to the other with sand; the sharp angles of the grains can be seen with the naked eye, and yet they do not injure the fine membranes through which they pass. The synapta has also a peculiar mode of meeting famine: just as a general turns out of a beleaguered city all the useless mouths, so does this creature cut off the useless parts of its body. It effects this by first forming a compression or ring, which gradually tightens until all that part of the cylinder which is below it drops off. A synapta has been known to continue this self-destruction until only the head was left, and in that head resided the life, which, as soon as food was supplied to it, began to reconstruct the body it had so unceremoniously rejected.

ROTATION.

POSSIBLY many of our readers have never thought that it is a very wonderful thing that a top should stand in a perpendicular position when spinning. Let any one try to balance a peg-top upon its point, and, after pronouncing the feat to be impossible, spin it, and see how readily the upright position is maintained; then possibly the peculiar fact may be realised.

Doubtless the velocipede will come into common use as a mode of locomotion. If it be true that 100 miles can be travelled in a day with little fatigue, there is quite sufficient reason why it should be used. But the velocipede of the present day is a very different machine from that with which we have been for some time familiar.

Hitherto the machine has been a light frame-work with four wheels, which were turned by the feet of the driver alternately pressing down two treadles attached to cranks upon the axles of the wheels. But the velocipede of to-day only possesses two wheels, and these are in a line, so that the hinder wheel runs in the track of the former. The driver sits upon a saddle, *a*, astride the frame-work which holds the short axles of the wheels, and works the former or driving-wheel, by treadles, *c* and *d*; he guides the machine by the handle, *e*. But what keeps the velocipede in its upright position, for two wheels in a line are as difficult to balance as a single wheel by itself? The very same power which holds the spinning-top in its upright position. Of course the machine must be mounted while in motion, or the passenger must be supported until the motion is commenced. The same force is illustrated in the gyroscope, which is a heavy rim of metal round an axis. When this is set in swift rotation the axis will remain stationary in any position provided one of its ends be supported. This strange property which a revolving body possesses is called *the fixity of the axis of rotation*, and it is the result of a general law that when matter is in rotation its axis, or the line upon which it rotates, remains stationary. So the axes of the top, of the velocipede, and of the gyroscope, all remain in their various positions in defiance of the ordinary law of gravitation.



BICYCLE VELOCIPEDE.

This is a great law, and we are much indebted to it; for it is owing to its operation that our zones and the succession of our seasons remain unchanged. The earth rotates on her axis, and because of that rotation the position of her axis is fixed. Were this not so the Esquimaux might in a few hours be under a burning tropical sun, and the efforts of the people in India to keep themselves cool might be rendered unnecessary by suddenly finding themselves within the Arctic Circle. And so it comes to pass that the earth's motion is absolutely necessary to her stability.

Another of the effects of rotation is to throw away at a tangent all the particles of the revolving body. If, for instance, a piece of clay or putty be stuck on the surface of a humming-top, when the top is spun the clay will fly off. If the whole body of the top were clay, the effect would be to bulge out the middle, and the more rapid the rotation the flatter would the top become. This is precisely the way in which our earth has been flattened at the poles. The polar diameter is twenty-six miles shorter than the equatorial. Some geologists have held the opinion that the thirteen miles of matter from each pole was denuded or washed by the rain, and carried by the ocean currents towards the equator; but this can be disproved by the astronomical effects our earth has upon the moon's motion.

There is then no doubt that the rotation of the earth causes the matter of which the globe is composed to endeavour to place itself, as far as its own cohesion will permit it, from the axis of rotation, so producing a flattened spheroid. If the earth rotated seventeen times faster than she now does—that is, if a point on the equator passed through 17,000 miles in an hour—the force which tends to throw off bodies from the surface would be so increased as to overcome the attraction of gravity, and consequently bodies at the equator would be without weight. This effect of rotation will account also for the fact, that things if weighed by a spring balance, are found to have less weight on the summit of a mountain than in the valley beneath. How the fact of the earth's rotatory motion has been proved, will form the subject of a future paper.

CROWNS.

CROWNS, ornaments of the head denoting imperial or royal dignity, have a curious history, traceable from a mere fillet, or circlet of gold, to their adornment with the richest jewels. The radiated appears to be the earliest form of the royal crown with which we are acquainted. It is found upon Persian, Syrian, and Greek coins, and on that of Augustus and other emperors, down to the destruction of the Roman empire.

The strophium, bandelet or fillet, and the laurel wreath were used as crowns in very remote ages. In Constantine's time the fillet of pearls came into use, which the later Byzantine emperors turned into a coronet. It was originally a mere fillet, then a garland, subsequently stuff adorned with pearls. Manuel Palæologus, crowned in 1363, wore a close crown studded with pearls.

The trefoil upon the crown is thought to be of Gothic introduction. We find it upon the coins of Clovis and his sons, which has induced antiquaries to call it the *fleur-de-lis;* but the truth is, these trefoils were used on Constantinopolitan crowns before the time of the Franks, and afterwards on those of German princes in no way allied to Charlemagne. Aubrey, the antiquary, was of opinion that the *fleur-de-lis* is really a spear-head adorned, no flower of the lily kind having the middle part solid.

The Iron Crown of Lombardy takes its name from the narrow *iron* band within it, which is about three-eighths of an inch broad, and one-tenth of an inch in thickness. This band is traditionally said to have been made out of one of the nails used at the crucifixion, and given to Constantine by his mother, the Empress Helena, the discoverer of the cross, to protect him in battle. Afterwards it was used at the coronations of the Lombard kings, primarily at that of Agilulphus, at Milan, in the year 591. The outer circlet of the crown is composed of six equal parts of beaten gold, joined together by hinges, and set with large rubies, emeralds, and sapphires, on a ground of blue gold enamel. Within the circlet is the iron band without a speck of rust, although it has existed for more than 1,500 years. When the Emperor Napoleon was crowned king of Italy (at Milan, May 23rd, 1805), he placed the iron crown upon his head with his own hands, exclaiming, "*Dieu me l'a donné, gare à qui la touche*" (God has given it to me, beware who touches it), which was the haughty motto attached to it by its ancient owners.

"Luke's iron crown" was a punishment inflicted anciently on regicides or other criminals, in Hungary, and consisted of placing a crown of iron, heated red-hot, upon the head. The Earl of Athol, who was executed for the murder of James I., king of Scots, was previously to his death, crowned with a hot iron. It may be in reference to this that in Shakespeare's "Richard III.," act iv. sc. i., we read—

> "Oh, would to God that the inclusive verge
> Of golden metal that must round my brow,
> Were red-hot steel, to sear me to the brain!"

The Hungarian crown, worn at their accession by the emperors of Austria, as kings of Hungary, is the identical one worn by Stephen, 800 years ago. It is of pure gold, and weighs 9 marks 6 ounces (14 pounds). It is adorned with 53 sapphires, 50 rubies, 1 emerald, and 338 pearls.

With regard to the crown used in our own country, a fillet diadem of pearls appears on several of the Saxon Sceattæ. Similar diadems or fillets adorn the heads of many of the Heptarchic kings. Alfred's crown has two little bells attached; it is said to have been long preserved at Westminster, and may have been that described in the Parliamentary inventory taken in 1649. The circle, surmounted by three small projections, first occurs upon the coins of Athelstan; on some of Edred's coins the projections end in pearls. A radiated cap appears first on a coin of Ethelred II., and the trefoil ornament is upon a few of the coins of Canute. Several varieties of arched cap and crown appear upon the coins of Edward the Confessor. The close or arched crown, which appears on some of the Confes[illegible]s, is used on all the types of Harold, and was adopted by the earlier Norman kings. On the Confessor's and the Conqueror's coins we see labels appended at each ear; these, as we learn from an anecdote related by William of Malmesbury, in wearing the crown, were fastened by a clasp or button beneath the chin. William I. wore his crown on a cap adorned with points and leaves alternately, each point being tipped with three pearls, while the whole crown was surmounted by a cross. William Rufus discontinued the leaves. On the coins of Stephen and Henry II. the open crown, with *fleur-de-lis*, appears. Henry III. was crowned with a plain circle of gold, in lieu of the crown, which had been lost with the other jewels and baggage of King John, in passing the marshes of Lynn, on the Wash near Wisbech. Edward III. wore his crown ornamented with points *fleurs-de-lis* alternately, and *fleurs-de-lis* and crosses, as at present. Selden had read that Henry V. was the first of them who wore the arched crown, and in a window of Ockholt manor-house, in Berkshire, 1465, there certainly remained, till within a few years, the arms of Henry VI. and his queen, Margaret of Anjou, in separate coats, both surmounted by the arched barred crown; from Henry VII. downward, this arched crown, with the globe and cross, has been continued.

"St. Edward's crown" was made in imitation of the ancient crown said to have been worn by the Confessor, and kept in Westminster Abbey

till the beginning of the civil war in England, when, with the rest of the regalia, it was seized and sold. A new crown was prepared for Charles II.

A magnificent crown was made for George IV. with the jewels of the old crown, and jewels borrowed of Rundell and Bridge, the Crown jewellers. This crown was fifteen inches in height; the arches were not flat as in the former crown, but rose almost to a point, and were surmounted by an orb of brilliants, upon which was placed a Maltese cross of brilliants, with three fine pearls at its extremities. The arches were wreathed and fringed with diamonds, and four Maltese crosses of brilliants surrounded the crown, with four large diamond flowers intervening. On the centre of the back cross was the ancient ruby, which was worn at Cressy and Agincourt by the Black Prince and Henry V.; while the centre of the front cross was adorned with a unique sapphire, more than two inches long, and one inch broad; and a band of large diamonds, emeralds, sapphires, and rubies completed this magnificent diadem. It was estimated to be worth £150,000, and the expenses upon it, preparatory to the coronation of George IV., amounted to £50,000 or £60,000, over and above the addition of the inestimable sapphire.

The state crown of Queen Victoria was made for Her Majesty, by Rundell and Bridge, in 1838, with jewels taken from old crowns, and others furnished by the queen's command. The following is a summary of jewels in the crown: 1 large ruby, 1 large broad sapphire, 16 sapphires, 11 emeralds, 4 rubies, 1,363 brilliant diamonds, 1,273 rose diamonds, 147 table diamonds, 4 drop-shaped pearls, and 273 pearls. Unlike most other princely crowns in Europe, all the jewels in the British crown are really precious stones; whereas, in other state crowns valuable stones have been replaced by coloured glass.

Odd mischances befall crowns. At the close of the late Abyssinian war, the true crown of King Theodore was bought at the capture of Magdala, from a common soldier, by a Prussian officer attached to the expedition, and was by him presented to his sovereign. His Majesty had his attention drawn to Lord Napier's order, forbidding the sale of articles taken by the army, and the crown was forwarded to the British Government.

THE DIAMOND MILL AT AMSTERDAM.

The diamond mill is one of the most interesting objects in Amsterdam. It belongs to a Jew, whose son, a clever lad, obligingly conducted us through the rooms, and explained the various parts of the process of polishing diamonds. Four horses turn a wheel, setting in motion a number of smaller wheels in the room above, whose cogs, acting on circular metal plates, keep them in continued revolution. Pulverised diamond is placed on these, and the stone to be polished, fastened at the end of a piece of wood by means of an amalgam of zinc and quicksilver, is submitted to the friction of the adamantine particles. This is the only mode of acting on diamond, which can be ground, and even cut, by particles of the same substance. In the latter operation diamond dust is fixed on a metal wire that is moved rapidly backwards and forwards over the stone to be cut. You are probably aware of the distinction between a rose diamond and a brilliant. The one is entire and set vertically, the other is divided and set horizontally. The largest diamonds are reserved for roses, which always rise in the centre to an angle; the smaller are used as brilliants, and have a flat octagon on the upper surface.—*Elliot's "North of Europe."*

THE VENDETTA.

The manners and customs of savage tribes often seem wonderful to people like ourselves, but there are to be found in communities professedly civilised many things equally strange and even barbarous. A striking instance of this is seen in what is known in the islands of Corsica and Sardinia, where it flourishes, as the *vendetta*, or the *vengeance*. The term is used to designate what has long been an established usage in these islands—namely, the taking personal revenge for the shedding of blood, instead of leaving retribution to the ministers of the law, according to the fundamental principle and practice of civilised society.

The origin of the vendetta may be traced to those rude and troubled times when civilisation, in the proper sense of the term, was only dawning in Europe. Even in what are called the middle ages, the great families of Italy were constantly engaged in this kind of conflict, and the same thing was seen in our own land, in the incessant feuds which ravaged the Scottish Border.

The Italians are proverbially a revengeful race, and to this fact it is, no doubt, chiefly owing that this open and recognised practice of personal vengeance lingered longer in Italy than elsewhere, and that its vestiges are still to be found in the vendetta of Corsica, and the adjacent island of Sardinia, whose inhabitants by descent are purely Italian. In Sardinia especially, the practice prevails at the present hour; but in Corsica it has lately been kept in check by the energetic measures of the French authorities.

In the minds of the people of those islands the vendetta is an institution held in the highest respect. It is regarded as a paramount duty that if an individual be murdered, his nearest male relatives shall slay the murderer. If they cannot reach him, they are bound by this immoral code of

honour to take blood revenge upon his relations; and as this practice has been going on for many generations, there are always numbers of people in both islands who are engaged in this deadly feud, thirsting for blood on the one hand, and living in constant terror of the vendetta upon the other. Some have been known to live for years with their houses barricaded, and never to stir out, even to their ordinary occupations, without being well armed and on their guard against the enemy, who may be lurking in ambush. For any amount of treachery may be practised in accomplishing the vengeance, without incurring the reproach or the hatred of the rest of the community. Only one thing is disgraceful in the eyes of a true Corsican or Sardinian, and that is to leave the stain of blood without fresh blood shed upon it. The women, even, incite the men to follow this hateful practice, and in many cases are the most active in keeping up the vendetta, by reproaches against their male relatives for neglect or delay in its pursuit.

It will easily be imagined what must be the result of such a fearful institution in secluded communities, such as are found in these islands. Both the French and the Italian governments have made many efforts to reach and punish offenders, but their search after culprits was frequently ineffectual, the murderers betaking themselves to the mountains, where they resorted to brigandage for subsistence, as they dared not show themselves where the officers could reach them. The sympathies of the people were, as a rule, with the criminals pursued; and their places of concealment, if known, were rarely divulged to the authorities. The chief result of these attempts to suppress the vendetta was, therefore, to cause the islands to be infested with bandits, while the murderous institution flourished as vigorously as ever.

Corsica was becoming positively uninhabitable, when the French government, under the present Emperor, determined, with its accustomed vigour, to adopt a more effectual measure of repression. It decided upon disarming the entire population, and making it a punishable offence for any of the inhabitants to be seen carrying a gun. Shooting of any kind, even by visitors, was strictly forbidden in Corsica, unless a special licence had been granted by the authorities. These regulations are in force at the present time, and the result has been to give an effectual check to the system. No doubt, the old spirit still slumbers, but it may be hoped that the continued exercise of the same firm rule will in time destroy this terrible habit.

In the island of Sardinia the Italian authorities have never yet ventured upon the same decided step, and therefore the vendetta goes on very much as it has done from time immemorial. Other influences, however, are at work to alleviate it, and although they cannot effectually cope with it, they are yet occasionally productive of good. Only a few weeks back the Italian papers contained a curious account of the extinction of a blood feud in the island. In the village of Agiuo two hostile bodies, who for more than two years had been persecuting and murdering each other, agreed, apparently through the persuasion of the priests, to forget their animosities and join hands in friendship. The two hostile families, we are told, entered the church simultaneously, amidst the ringing of bells and the acclamations of the people, and ranged themselves on opposite sides, one party, more than sixty in number, along one wall of the building, and the rest, fifty-four in number, on the other. The curé then pronounced a discourse on mutual forgiveness, which produced a deep sensation, and the hostile parties, moved even to tears, threw themselves into each other's arms, promising a permanent reconciliation. After leaving the church the two families separated for a short time, and then met again at the house of the curé, where the friendly compact was confirmed in presence of the authorities.

BOHEMIAN GLASS.

In the manufacture of glass the Bohemians followed the Venetians, and the art is still largely practised in that country. The glass works of Bohemia at this day afford subsistence to more than 30,000 persons.

Glass was first used by the Italians for cameos and intaglios, by impressing it while warm into a mould of tripoli, the glass being sometimes baked with plaster of Paris; thus are made copies of antique gems. The more ancient productions were only partially enclosed, as we see in the picture of a duck described by Winckelmann, or the arabesque mosaic in the British Museum, the paintings being neither completely enclosed nor protected from the air. Among the celebrated ancient specimens is the Naples Vase, exhumed at Pompeii, 1839. It has white enamel figures upon a dark blue transparent ground, being raised or embossed out of the white exterior coating by first-rate engravers, probably Grecian artists working in Rome, about 70 years after the Christian era. The mode of casing, or placing two or more coats of glass upon each other, and then cutting out the design, is very curious.

There is also a beautifully engraved glass vase, by a Bohemian artist, the subject from Le Brun's painting of the conquest and final overthrow of the Persians at the battle of Arbela, by Alexander the Great. For depth of workmanship and artistic execution, as a modern intaglio engraving, this vase was unrivalled. We have been informed that the artist lost his sight through its execution.

WESTERN FRONT OF ST. MARK'S.

ST. MARK'S, VENICE.

Of all the wonders of architecture in the city of Venice, the church of St. Mark is by far the greatest, both for beauty of conception and beauty of design. To describe it in detail would require a volume, it will therefore be the object of the present article to point out, with its origin, its chief characteristics.

St. Theodore was originally venerated as the patron saint of the city, and before the ninth century, a church on the site now occupied by St. Mark's was erected to him, this church afterwards serving as chapel to the adjoining Ducal Palace. But when, in 828, the Venetians acquired the body of St. Mark, and deposited it in the church of St. Theodore, they thought it only right that a relic so prized should have a suitable resting-place. Accordingly, the old church was destroyed and a new one built to St. Mark, who thenceforth became the patron saint of the city. This church, however, was destroyed by fire in 976. It was partly rebuilt on a much grander scale by the Doge Pietro Orseolo, and the work was carried on for nearly 100 years, the main part of the building being finished in 1071, and consecrated between 1084 and 1096. It was again injured by fire in 1106, but repaired, added to, and embellished by each successive generation, so that it bears the marks of several successive schools of architecture. The principal part of the building of the eleventh, twelfth, and thirteenth centuries is Byzantine, of which the chief characteristics are the round arches to the doors and windows, and the cupolas; the Gothic pinnacles, upper archivolts, and window-traceries were added to the exterior at the close of the fourteenth century, as well as the great screen and various chapels in the interior, while the restored mosaics are of the seventeenth century.

The great characteristics of the building, are the exquisite proportion of all its parts, its incrustation with precious marbles, and the number of its variegated columns. It has been computed that there are in the exterior and interior more than 500 pillars. The early builders of Venice were unable to procure marble and stone in sufficient quantities to make their buildings entirely of these materials, they

therefore built them of brick, and the marbles and other precious stones, obtained from Constantinople and other cities, were split up into layers and fastened on to the surface of the bricks, the surface of the layers being often wrought with delicate tracings and sculpture. St. Mark's is the finest example of this method of treatment. There are five doors, all of bronze, in the principal or western façade fronting St. Mark's place—the grand entrance, under a succession of beautifully sculptured arches, being in the middle. From this the arches of the two doors on each side, with those of the two porticoes, one at each extremity of the façade, are arranged in a gradually lessening proportion. The archivolts of these are wonderfully carved, while the recesses above the doors are filled with mosaics. On each side of the doors are clusters of pillars—in two ranges—of porphyry, alabaster, deep green serpentine, and fine marble, with their capitals richly sculptured. Above the arches of the doors is a round-arched balustrade running round the whole of the exterior of the building.

At different intervals in the walls are inserted tablets of ancient sculpture. From the lower storey of the building springs another series of white arches, edged with scarlet flowers, sheltering another series of Scriptural mosaics, their crests bearing statues of saints, and at their sides other canopied statues; and above these again springing from the roof, are seen five white domes, a large one rising over the middle of the Greek cross, which is the plan of the church, and a smaller one at each of the four sides. In the archivolt of the large upper central arch, is a sculptured lion of St. Mark, in a blue field covered with golden stars.

In the interior of the building a vestibule extends along the whole of the front, the roof covered with mosaics, and supported by many columns of precious marble. The choir is divided from the nave by a rich screen of fourteenth century work. The principal pillars that carry the nave and transepts are fourteen in number, each a single block of white alabaster veined with grey and amber, fifteen feet in height, and six feet two inches in width. The walls are sheeted with alabaster, the roof and the interior of the domes are filled with mosaics on a golden ground, while the floor is a tesselated pavement of many colours, and of varied and fantastic designs.

The interior of the church is but very dimly lighted by small apertures like stars set in the domes of the roof, and by the silver lamps that are always burning before the altars of the numerous chapels, so that it is difficult, even after the eye has become accustomed to the "dim religious light," to examine minutely all the wonders that the place contains, so beautifully described by Mr. Ruskin in the following passage from the "Stones of Venice." "Under foot and over head, a continual succession of crowded imagery, one picture passing into another as in a dream: forms beautiful and terrible mixed together; dragons and serpents, and ravening beasts of prey, and graceful birds, that in the midst of them drink from running fountains and feed from vases of crystal: the passions and the pleasures of human life symbolised together."

Our illustration, taken from the celebrated Piazza of St. Mark, will serve to give the reader an idea of the wonderful beauty of the exterior of this building, though it cannot show the marvellous beauty of the mosaics, and the colouring with which the cathedral is so profusely decorated.

THE YARD MEASURE.

EVERY ONE is acquainted with the nature and utility of the yard measure. It is the British standard of length, regulating all other measures, and consequently is the foundation of business transactions and professional operations of many different kinds. But its high utility is entirely dependent upon its fixed and uniform dimensions. It would be in the greatest degree inconvenient and unsatisfactory if a yard in one part of the kingdom meant something different to the measure which passed under the same name in another, or if the least variation were found in the yard measures of different parts. Hence it is necessary to have some authoritative standard by which the dimensions of the yard shall be accurately adjusted, and according to which the legality or otherwise of any measurement may be determined.

Many curious particulars are connected with the formation of this authoritative standard of the country; and few persons unacquainted with the facts would have any idea of the interest which thus attaches to so common an object as the yard measure. In our early history disputes often arose in the measurements of cloth, &c., and frauds were frequently committed. To check them Henry I. ordered a standard yard to be made and kept at Winchester, and decreed that it should be of *the length of his own arm*. This was a rough and ready mode of settling the matter, which presents the greatest contrast to the formation of a standard measure at the present time. The disadvantage attending it was that, in the event of the standard being lost or destroyed, it would be next to impossible to construct another of precisely the same dimensions. To avoid any such difficulty, a scientific basis has been taken in modern times for the formation of the standard yard measure. Plainly stated, this basis is *the length of a clock pendulum*, which vibrates seconds of time in the latitude of London. This may appear to some to be a simple rule, by which the standard may be determined with com-

parative ease; but on the contrary, it is a matter requiring the most minute and accurate research, which only astronomers and mathematicians of the highest attainments are competent to undertake.

Down to the year 1824, the standard yard of the country was a rod which had been deposited in the Court of Exchequer in the time of Elizabeth. All measures intended for general use were brought to be examined by an officer of the court, placed parallel with the standard, and stamped with certain marks if found correct. Their use for business purposes was thenceforth legal. By an Act of Parliament passed in 1824, this old standard was superseded by another which had been constructed under the auspices of the Royal Society in 1760. The act provided that "The straight line or distance between the centres of the two points in the gold studs in the brass rod, now in the custody of the Clerk of the House of Commons, shall be the original and genuine standard of a yard; and the same straight line, *the brass being at the temperature of 62° of Fahrenheit's thermometer*, shall be the unit or only standard measure of extension." The provision as to the comparison with the thermometer was founded on the well-known fact of the extension or contraction of metals at different temperatures, and illustrates the nicety with which all circumstances relating to the standard of measure are considered and adjusted.

This standard was destroyed by the fire which consumed the Houses of Parliament in 1834, and a commission was appointed to replace it. It had previously been enacted that "If at any time hereafter the imperial standard yard shall be lost, or in any manner destroyed, defaced, or otherwise injured, it shall be restored by making, under the directions of the Lords of the Treasury, a new standard yard, bearing the proportion to a pendulum, vibrating seconds of mean time, in the latitude of London, in a vacuum, and at the level of the sea, as 36 inches to 39·1393 inches."

The labour of reconstruction in accordance with this enactment was commenced by the celebrated astronomer, Mr. F. Baily. He died in 1844, leaving his researches to be continued by Professor Sheepshanks; and on the death of the latter gentleman in 1855, the work was taken up and completed by the present Astronomer Royal, Mr. G. B. Airy. Nearly a quarter of a century thus elapsed between the destruction of one standard and the completion of another to succeed it.

The new standard yard measure is deposited in the Houses of Parliament, and authenticated copies of it at the Court of Exchequer, the Royal Mint, the Royal Society, and the Royal Observatory at Greenwich.

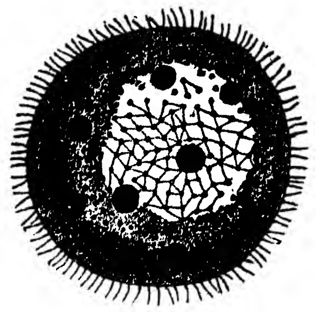
The French standard measure of length is the mètre, which is founded on the measurement of the earth from the pole to the equator in the meridian of Paris. This distance is divided into 10,000,000 equal parts, one of which parts is taken as the unit of length, and called a mètre from the Gre[illegible] a measure.

ANIMALCULES.

If some water is taken out of a pond, from near the edge or close to the flags and grasses which grow close to the side, it will usually be found to contain, during the summer months, a number of large globular animalcules. A common magnifying glass will just distinguish some specks which appear to move very slightly, but a good microscope proves that these small points are animalcules in the form of transparent orange-shaped masses. Each consists of a fine membrane covered with lace markings, and at the edge there is a delicate fringe of moving hairs (ciliæ) which causes the animalcule to turn round and round, and occasionally to move forwards. These hairs are found all over the globular mass, and they move with great rapidity, so that the animalcule, which is called a Volvox, is never still. Inside the membrane, and as it were in the middle of the creature, are several others of the same shape, and possessing the same lace-like markings and fine ciliæ. These revolve and turn about, and there may be even others inside them having the same construction and power of motion. They clearly float in water and within each other. There is no mouth, and in fact no opening whatever in the skin of the Volvox, and a very highly magnifying power shows that the outside membrane is without any passage by which food can get within. It shows that the lace-like markings where they cross each other, have small swellings, some being larger than others. The smallest swellings are animalcules with a delicate round body full of granules, and from their outsides the hairs project which are the ciliæ. Every small swelling has its animalcule and two ciliæ, and the cross-markings between the swellings are evidently the means of communication, for there is an extraordinary regularity in the general movement of the hairs so as to produce a constant and very slow twisting round of the whole Volvox. Volvox is, then, a family or colony of animalcules, each being independent and united to the others by the fine membrane and the cross-markings. When the larger swellings are examined they do not appear to be simply large animalcules, but there are three, four, or more of the smaller kind collected together and encircled by a layer of the thin membrane.

Several specimens of the Volvox may be examined in a drop of water at once, and nothing is more beautiful than their regularity of ornament, their colour, transparency, and complexity, or more wonderful than their graceful rotation. If left in

a proper glass, and if fresh water is supplied, the Volvox grows larger, and the single animalcules on the cross-markings, in many instances turn to those of the larger kind. The inside animalcules increase in size, and after awhile the outside membrane bursts and breaks up. Each of the round creatures within becomes a Volvox and bursts in its turn. But the animalcules of the outside membrane, those formed at the cross-markings, escape from the colony and swim about as free creatures. They are then recognised as round, green creatures, very active, and not at all like the old Volvox. During some time they remain in this shape, but at last they begin to enlarge, and their outside skin begins to have hairs upon it and lace-like markings. Finally they turn to the great globular animalcules.

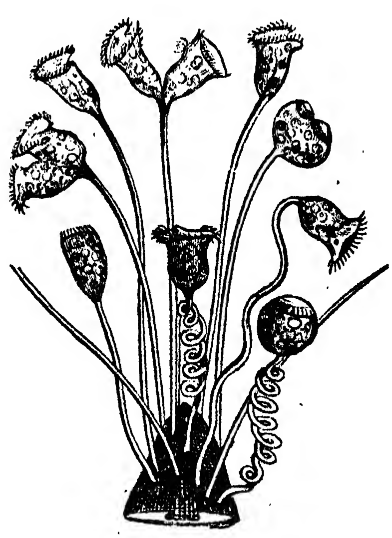


THE VOLVOX GLOBATOR.

The rapidity with which the Volvox grows, and produces animalcules within it and on its outside, which are again to become like the parent, is one of the most wonderful things in nature. The membrane which connects the colony together is as transparent as an air-bubble, and it is quite evident that the separate animalcules on the cross-markings have a tiny stomach and mouth. Sometimes when plants which grow in the water are examined in the hot weather, large pieces of soft stuff like jelly may be found upon them, looking very much like frog spawn without the dark part. Some of these pieces are as large as an apple, but usually they are of the size of a small pea. The stuff looks like pure white of egg; it is quite transparent, slightly tinged with green, and when placed on a piece of glass it drains away. But the microscope reveals that it is a colony of innumerable animalcules, each creature being about the hundredth part of a line in thickness, and the tenth of a line in length. The centre of the mass is hollow and contains water, and the animalcules are embedded in the jelly. Their numbers are enormous, for they are placed in close rows, one over the other. They have movable hairs upon one end, and they produce a great whirl amongst the small grains and minute animalcules which come near them. There are about 9,216 of these creatures in the space of a square line, and in the space comprised by a mass measuring an inch in height, breadth, and length, or a cubic inch as it is called, there are about 8,000,000.

When the jelly-like mass breaks up, each animalcule has a rate existence, and in time become a small transparent body, which as it grows produces the young within it, and which at last is like the original colony. But other animalcules, fish, and birds prey upon the jelly, and very few of its animalcules come to maturity. If they were not thus prevented from increasing, all the ponds in the world would soon become choked up by them.

One of the most wonderful animalcules is in the shape of a wine-glass with a bell mouth. The bottom of the body is attached by a long thread to substances in the water, and the rim is covered with the long hairs called ciliæ. Several round grains are seen in the inside of the body, which is very transparent, and inside the delicate thread there is one long muscular fibril. When the hairs begin to move, the creature stretches its thread out and anchors. As soon as it cannot move any more the hairs produce a whirlpool all round the rim of the glass-shaped body, and the minute particles in the water, and small animalcules of different kinds are guided into the creature's stomach. When too large a piece comes in contact with the hairs, the thin fibre in the thread pulls the body back violently and curls itself up like a spiral spring, or in cork-screw fashion. After awhile the animalcule sets its ciliæ at work again, and the spiral shape of the thread is undone. When the animalcule is well nourished it begins to split in two, and each division becomes a separate creature. If the thread should happen to break the animalcule must go forward until checked, and it is very common to see them swimming about without this attachment. After awhile they seem to lose it altogether and to become fixed before producing another elastic cable.



THE VORTICELLA.

OPIUM-EATING.

PROBABLY more than half the human race live in the constant use of opium as a stimulant and narcotic. In Eastern countries it is almost universal, and people find means to procure a small portion of the drug, if they can barely obtain sufficient food to prolong existence. Some, like the Turks, eat it, or swallow it in the form of pills; others, like the Chinese, smoke it; while in European countries, where its use is far less common, it is mostly taken liquid, as in laudanum.

Opium is procured from the unripe fruit, or heads, of the common or white poppy (*Papaver somniferum*); and the usual way of collecting it is to make incisions in the skin of these heads while they are still on the stalk, when there oozes from them a creamy juice, which becomes hardened on exposure to the air. This is afterwards scraped from the heads and made up into small cakes. The culture of the poppy for this purpose is an important branch of industry in India and in Asiatic Turkey. China alone imports from India opium to the value of ten millions sterling per annum, although it produces large quantities at home.

The narcotic effects of opium are occasionally of high utility in medicine, lulling pain, producing sleep, &c. But under ordinary circumstances, the use of opium as a stimulant is invariably attended with effects injurious in proportion to the quantity taken. In small doses it excites the nervous system and seems to expand the mental faculties; but this temporary elevation is followed by a corresponding period of depression. As it is taken in larger quantities, and it becomes necessary to increase the dose to produce the same effect, the digestive organs suffer, the energies of mind and body are weakened, until at last stupefaction and vacuity are the characteristic conditions of the opium-taker, after his first excitement has passed away. In excessive quantities it seems to destroy the mental faculties, and to reduce its wretched votary to the lowest state of misery, ending at last in premature death. It is rarely that a man habituated to the use of opium is able to break from his infatuated indulgence. In our own country, Coleridge and De Quincey, both opium-eaters, have left on record, in glowing language, their experience of the effects of this exciting but pernicious drug, and the difficulty they had to encounter in their determination to renounce it.

Chinese OPIUM-SMOKERS.

As regards the general effects of opium, the picture given by Dr. Madden, in his "Travels in Turkey," affords perhaps the best illustration :—"I commenced with one grain. In the course of an hour and a-half it produced no perceptible effect. The coffee-house keeper was very anxious to give me an additional pill of two grains, but I was contented with half a one; and in another half-hour, feeling nothing of the expected reverie, I took half a grain more, making in all two grains in the course of two hours. After two hours and a-half from the first dose, my spirits became sensibly excited;

the pleasure of the sensation seemed to depend on a universal expansion of mind and matter. My faculties appeared enlarged; everything I looked at seemed increased in volume; I had no longer the same pleasure when I closed my eyes which I had when they were open. It appeared to me as if it was only external objects which were acted on by the imagination, and magnified into images of pleasure: in short, it was 'the faint, exquisite music of a dream' in a waking moment. I made my way home as fast as possible, dreading at every step that I should commit some extravagance. In walking, I was hardly sensible of my feet touching the ground; it seemed as if I slid along the street, impelled by some invisible agent, and that my blood was composed of some ethereal fluid, which rendered my body lighter than air. I got to bed the moment I reached home. The most extraordinary visions of delight filled my brain all night. In the morning I rose pale and dispirited; my head ached; my body was so debilitated that I was obliged to remain on the sofa all day, dearly paying for my first essay in opium-eating."

So far as to the effects of a single dose; but the condition of the confirmed opium-eater is thus depicted by another writer:—"A total attenuation of body, a withered yellow countenance, a lame gait, a bending of the spine, frequently to such a degree as to assume a circular form, and glassy, deep-sunken eyes betray him at the first glance. The digestive organs are in the highest degree disturbed; the sufferer eats scarcely anything. His mental and bodily powers are destroyed; he is impotent. His torments, when deprived of the stimulant, are as dreadful as his bliss is complete when he has taken it. After long indulgence he becomes subject to nervous pains, to which opium itself brings no relief. He very seldom attains the age of forty if he have begun the practice early."

The excitement of opium acts differently on persons of different constitution, and individuals of different race. The apathetic Turk shows little sign of its influence; the Malay under it often becomes a raving and dangerous madman.

Lord Macartney describes as follows an effect of opium often witnessed among the people of Java:—"The Javanese, under an extraordinary dose, become frantic as well as desperate. They acquire an artificial courage, and when suffering from misfortune and disappointment, they not only stab the objects of their hate, but sally forth to attack in like manner every person they meet, till self-preservation renders it necessary to destroy them." As they run they cry, "*Amok! amok!*" meaning, "Kill! kill!" and hence the term which has become adopted into English usage, "running amuck" at anything.

There is no reason to believe that the use of opium for private consumption is large in England, but it is a frequent ingredient in "cordials" and "balsams," which are sold for children, and its effects in that form are most pernicious.

The illustration represents three opium-smokers, one of whom has already succumbed to the soporific effects of the drug, while the other two are in the earlier stages of enjoying it.

THE MARQUIS OF WORCESTER'S INVENTION OF THE STEAM-ENGINE.

A COMPENDIOUS statement of facts, with its elaborate notes and references, drawn up by Mr. Benet Woodcroft, of the Patent Office, may be considered to set at rest the claim of Edward Somerset, the second Marquis of Worcester, to the invention of the steam-engine. In his "Century of Inventions," written in 1655, lost, re-written, and published in 1663, appears the first published account of his invention, which Mr. Woodcroft describes as "the marquis's fire-engine, or water-commanding engine; an elementary steam-engine; a modern name applied to an old invention, previously known as a fire-engine, and afterwards as an atmospheric engine." There is every reason to believe that the MS. of 1655 contained the same or a similar account of the marquis's "water-commanding engine" to the one printed in 1663. This year, in May, he obtained an Act of Parliament for the sole use of his invention, and, according to its requirements, he would have to deposit a model of his invention. The same year (1663), the French traveller, Samuel Sorbière, saw the same engine at work at Vauxhall; and Lord John Somerset, the marquis's eldest brother, was living at Vauxhall in 1664. Cosmo III., Grand Duke of Tuscany, saw the engine at Vauxhall in 1669; and Walter Travers, a Roman Catholic priest, writes in reference to it in 1670—"Its existence must also have been known to Dr. Thomas Sprat, F.R.S., who criticised Sorbière's 'Book of Travels' in 1665, and also to the Hon. Robert Boyle, F.R.S., to whom Dr. Hooke sent the marquis's 'Definition' of his invention. The celebrated Dr. Robert Hooke, F.R.S., who, early in 1667, went to see the engine, wrote to Boyle on the subject. Lord Brereton is named by Dr. Hooke as having made a bet that the invention would not answer. The Earl of Lotherdale was written to in 1660 by the marquis, with a copy of his 'Definition.' The marquis's widow, the Dowager Marchioness of Worcester, re-married, and died in 1681, to which time the engine itself, or models, or drawings, no doubt were carefully preserved."

The marquis died in 1667, and it is related that the model of his engine was placed in his coffin, or in the family vault in Raglan Church, where he was

interred. There is another story that the model was deposited in the Tower of London, but there is no foundation for either of these anecdotes.

His son and heir, Henry Somerset, first Duke of Beaufort, died in 1699. It was not until five months after the duke's death that Thomas Savary exhibited the model of his alleged invention before the Royal Society in 1699.

Of the hundred inventions described in the marquis's "Century of Inventions," the last three may justly be considered as the most important; and if to this we add another, No. 68, says Mr. Partington, they appear to suggest nearly all the data essential for the construction of a modern steam-engine.

Mr. Woodcroft, as the working chief of the Patent Office, has accumulated a very considerable amount of information on the origin of inventions, and has made an interesting discovery respecting the confidence felt by the Marquis of Worcester in the ultimate success of his engine. He was so poor during the Protectorate that a document still in existence, signed by Oliver Cromwell, requests the Treasury to pay him £3 weekly. Charles I. had given him a warrant for the sum borrowed from the marquis, of £40,000; and on the restoration of Charles II., that sovereign is said to have offered him two estates in lieu of the money. But, according to one of the patent rolls, the marquis preferred to take back one tenth "royalty," then due to the king on the eventual profits of his patent.

Antiquarian Curiosities.

The Sirloin Table.—There is now, or was lately, at Friday Hill House, in the parish of Chingford, Essex, the oak table upon which King Charles knighted the loin of beef. The house is a large building, containing more than thirty rooms, and is in a dilapidated state, but has lately been repaired. Report has it that it was originally a hunting seat of Queen Elizabeth. The table is thick, and has a clumsy appearance, is made of English oak, and from the effects of time is a little decayed. Some of the knots of wood have been lately taken out, and pieces of oak of the same age neatly let into it, and the top newly polished.

A Very Stale Loaf.—The antiquary may be gratified with the sight of a loaf of bread upwards of 600 years old. It was included in a grant of the crown in the reign of King John, and has remained with the writings of the estate in the Soar family, of Ambaston, in Derbyshire, ever since. A correspondent says he has seen and handled it, at intervals, during the last fifty years, and finds no alterations, except what may have arisen from the pilfering of a few crumbs by the curious.—*Nottinghamshire Review*, August, 1838.

Origin of High Pews.—Bishop Burnet complained that the ladies of the Princess Anne's establishment did not look at him while preaching his "thundering long sermons," as Queen Mary called them, but were looking at other objects. He therefore, after much remonstrance on this impropriety, prevailed on Queen Anne to order all the pews in St. James's Chapel to be raised so high that the fair delinquents could see nothing but himself when he was in the pulpit. The princess laughed at the complaint; but she complied when Burnet told her that the interests of the church were in danger. The whim of Bishop Burnet was imitated in many places which had not been pewed in this fashion before.—*Strickland's "Lives of the Queens."*

Origin of Blind Man's Buff.—This favourite sport of childhood and youth is of French origin and very high antiquity, having been introduced into England in the train of the Norman conquerors. Its French name, "Colin Maillard," was that of a brave warrior, the memory of whose exploits still lives in the chronicles of the Middle Ages. In the year 999 Liege reckoned among its valiant chiefs, one Jean Colin. He acquired the name of Maillard from his chosen weapon being a mallet, wherewith in fight he used literally to crush his opponents. In one of the feuds which were of perpetual recurrence in those times, he encountered the Count de Louvain in a pitched battle, and, so runs the story, in the first onset Colin Maillard lost both his eyes. He ordered his esquire to take him into the thickest of the fight, and, furiously brandishing his mallet, did such fearful execution that victory soon declared itself for him. When Robert of France heard of these feats of arms he lavished favours and honours upon Colin, and so great was the fame of the exploit that it was commemorated in the pantomimic representations that formed part of the rude dramatic performances of the age. By degrees the children learnt to act it for themselves, and it took the form of the familiar sport. The blindfolded pursuer, as, with bandaged eyes and extended hands, he gropes for a victim to pounce upon, seems in some degree to repeat the action of Colin Maillard, the tradition of which is also traceable in the name, blind man's buff.

The Order of the Horse-shoe.—Oakham, in Rutland, is remarkable for an ancient custom still in vogue, that every peer of the realm, the first time he passes through that town, shall give a horse-shoe to nail upon the castle gate. If he refuses, the bailiff of the manor is believed to have the power, by right of this ancient usage, to stop the coach and take a shoe from one of the horses. This is called the "Order of the Horse-shoe," and it is common for the donor to have a large one made, with his name engraved on it, and often in gilt. The gate of the old castle is completely

studded with shoes presented in conformity with this custom. Over the judge's seat in the assize hall, is one of very curious workmanship.

A COAL FOREST.

THAT the hard stony substance coal should have anything in common with wood, except that they both easily burn, seems at first sight very improbable. It is nevertheless true that they differ very little except in appearance; that their properties are nearly the same; and that, indeed, coal was originally formed of wood and other vegetable matter.

True coal is found associated with some of the older rocks of the crust of the earth, and so abounds in one series of them as to give to it the name of the Coal Measures. The earth has seen many changes since the rocks of these measures were laid down as mud or sand at the bottom of lakes and seas. And these changes have left indelible records in the rocks of the earth. An extensive group of deposits was added to the older or Primary rocks, and the whole of the immense thicknesses of sand, clay, and lime, which form the Secondary and Tertiary periods of geologists, have been deposited since the plants of the Coal period flourished on the surface of the earth. In tracing back the history of vegetation through these various deposits, as shown by the remains of the plants preserved in them, we get an unbroken series exhibiting the changes that have taken place in converting soft wood into the hard stony substance coal. The peat mosses which are now forming on the surface of the earth are composed of the decomposing remains of the vegetation which but recently flourished on the places where they occur. With a little care the different plants can be sufficiently separated from the decaying mass to determine what they are. A considerable change has taken place in their appearance. They have become dark in colour and friable. But the oak, alder, and fir can easily be identified as similar to trees now growing in Britain. A further step towards coal is found in the tertiary brown coal of Germany, in which the form and structure of the plants are still very obvious, but the substance is harder, and more like stone. And then in the jet and secondary coal of Yorkshire and the North of Scotland, we have a substance intermediate between the brown coal of Germany, and the true primary coal. All these different substances—wood, peat, brown coal, jet, and true coal, when subjected to examination by the chemist, by means of the retort, yield similar products, and are found to differ chiefly in the amount of oxygen which has been given off from the older specimens, and in the smaller bulk into which they have been compressed.

The substance of the coal, although entirely composed of vegetable matter, seldom contains fragments that can be recognised. These abound in the beds above and below the coal itself. The coal always rests on a bed of fine mud changed into stone, and called shale. This is generally much lighter in colour than the other shales of the series, and it abounds in a fossil named *Stigmaria*, from the number of dots or pits all over its surface. This very common fossil was long believed to have been a water-plant, which, when it died, sank down into the mud, and was there buried and preserved. It is now known to be the roots of the great trees whose remains have chiefly formed the coal which rests on the shale, in which these roots are still embedded. They were large fleshy roots, and gave off numerous long cellular rootlets from the pits, with which they are completely covered. The soft structure of the rootlets and their great number, would enable the trees to withdraw a large amount of moisture from the wet soil in which they grew.

The trees to which the *Stigmaria* belonged, had a very singular aspect. They were straight, simple, or branched stems, growing to a height of from fifty to eighty feet, entirely bare throughout the greatest portion of their length, but densely covered on the upper part with very long and slender leaves. The bare portion of the stem was marked with parallel flutings, and the elevated flattened ridges were ornamented with the impressions of the fallen leaves, which, as they were very regular, both in their form and arrangement in each species, gave rise to the name *Sigillaria*, by which the fossils are known. The trees had an appearance similar to that of the immense leafless cactuses of America, except that, instead of spines or hairs, the fossil bore true leaves. From this resemblance some naturalists have believed them to have been ancient cactuses, but the structure of the stem, and especially of the fruit, proves most conclusively that they occupy a much humbler place in the vegetable kingdom, and are true Cryptogams. The fruits which are preserved in the coal measures are very rarely found so connected with plants as to indicate the particular species to which each kind belonged. Only one observer has hitherto detected the fruit of *Sigillaria* connected with the foliage and stem. He found it to consist of several small roundish cases, borne on the somewhat enlarged bases of the leaves. These cases did not contain seeds but spores, and the structure and arrangement of the spores show that these remarkable trees are very nearly related to the small creeping plants called club-mosses, found on our mountains.

The *Sigillaria* lived not only in the clay below the coal, but found also a suitable soil in the increasing mass of decaying vegetable matter which subsequently formed the coal. When, from a change in the level of the surface of the land or other

Lepidodendron Calamites.

A COAL FOREST.

Sigillaria Calamites.

cause, the coal was submerged, and gradually covered with mud or sand, these trees stood erect and were surrounded by the mud or sand. They withstood decomposition until several feet of the deposit was formed. These short trunks in the roof shale of a coal mine are a source of serious danger to the miner, for when the coal is removed from below, the bed containing them dries to some extent, and the trunks, sometimes two yards in diameter and several feet high, easily separate from the rock because of the layer of coal which surrounds them, and often fall on the workmen.

The *Lepidodendron* was as abundant as the *Sigillaria*, and though nearly related to it, it had a very different appearance. The stem was covered with beautiful markings, arranged spirally, and was repeatedly branched like our ordinary forest trees. The leaves were short and flat, and the fruit was a cone produced at the end of the branches. Although as large as the cones of many fir trees, it has all the characteristics of the small cones of the club-moss. This tree grew to a height of fifty to seventy feet.

The aspect of the abundant fossil known as *Calamitis* was very different from that of the other plants associated with it, and of any tree in our forests; but it exhibited at that early period of the earth's history the form and appearance of one of our humble marsh plants, the equisetum, or horsetail. It had a tall, slender, smooth stem, marked on the lower naked portion with rings of pits from which branches had fallen. The branches were given off at intervals in rings or whorls, and these again branched and re-branched in the same way. The leaves were needle or wedge-shaped, and arranged also in whorls. The fruit was borne at the ends of the branches, and agreed in the most minute particulars with those of the horsetail.

These three types of plants formed the principal trees of the coal period. The dense damp forests in which they flourished had a very different aspect from anything to be seen on the earth at the present day. But the plants themselves have very near allies, from which they differ chiefly in the great size to which they attained, and the necessarily more highly organised stems they possessed. Ferns are the only Cryptogams which reach the size of trees at the present day; but it is remarkable that the ferns which abounded in the coal period were generally humble plants, only in one or two cases having a stem of any length, while on the other hand the small club-mosses and horsetails of our day attained at that early period a size that equals or even surpasses the trees of our forests.

The animals which most abound in the coal measures were inhabitants of the water, and breathed by gills; besides these a few air-breathing animals have been found, such as insects and lizards. One of the largest of these lizards has been introduced into the landscape—the *Archegosaurus*, or primeval lizard.

Wonders of Natural History.

A Wonderful Floating Snail.—There is a small snail which is so fond of the sea that it never comes to land, and it builds such a capital boat for itself and its eggs that whilst large ships are sinking and steamers are unable to face the storm, it tosses about in perfect safety. The little snail is of a violet colour, and is therefore called Ianthina; it has a small shell, and there projects from the under part of the body a long tongue-like piece of flesh. This is the raft, and it is built upon most scientific principles, for it has compartments in it for air. It is broad and the air compartments are underneath, so that it cannot capsize. Moreover, the snail knows how to stow away its cargo, for the oldest eggs, and those which hatch the soonest are placed in the centre, and the lightest and newest on the sides of the raft. The Ianthina fills its own air compartments by getting a globule of air underneath its head; the body is then curved downwards beneath the raft, and the head being tilted on one side, the air rushes up and fills the spaces. It feeds on a beautiful little jelly-fish which has a flat raft-like form, with a pretty little sail upon it, and they congregate in multitudes when the sea is calm. Sometimes specimens are washed upon the south-western coasts of England, and when they are handled they give out a violet dye.

Waterton.—Some forty years ago, Mr. Waterton, when travelling in South America, had an adventure which was then received with incredulity. This was his riding on the back of a living alligator. But the truth of it is attested by Mr. Verbeke, of British Guiana, who, when travelling on the Upper Essequibo River, fell in with a half-caste Indian, who had been the steersman of Waterton's canoe, and confirmed the truth of the statement, he himself being present at the capture of the alligator.

Animal Life at Great Depths in the Sea.—Sir John Ross, in many of his soundings, found living sea-worms, or *Annelids*, at depths varying from 192 to 1,000 fathoms. At the depth of 800 fathoms, he found a beautiful *Caput Medusa*, entangled on the sounding-line, which is still in the British Museum. It measured two feet in length when fully expanded.

Ape's Nest.—M. du Chaillu discovered that the bald-headed ape, Shiego Mbouve, builds a nest from fifteen to twenty feet from the ground, in the branches of trees, which stand apart from others, and have no limbs below that on which the nest is placed. Our traveller could scarcely persuade himself that human hands had not built the nest, so perfect was its construction, and impervious to rain; yet the ape never occupies a nest more than eight or ten days.

THUNDER-STORMS.

THUNDER-STORMS may be fairly classed with hurricanes and earthquakes, among the most appalling of all the convulsions of nature which are presented to our senses. When we come to look into them more closely, we find that their cause is easily discovered, and that the laws which govern them are well defined.

The rain which falls in tropical countries is almost always accompanied by thunder. Boussingault assures us that in South America, close to the equator, an observer gifted with very delicate hearing would perceive the thunder rolling continuously about him. In Abyssinia, D'Abbadie, after four years' experience, gives 410·6 as the annual average number of storms. Many of these are, however, only of very short duration, and they occur principally in the summer. The usual time at which the storms occur is in the afternoon, just after the hottest period of the day. Captain Caldcleugh says of Rio Janeiro, "Formerly, it was usual, in forming parties of pleasure, to arrange whether they should take place before or after the storm." D'Abbadie, out of 1,909 storms, only observed twenty-two between midnight and eleven o'clock in the morning. Thunder-storms are much rarer in cold climates; the four Russians who were compelled to spend six years on an island near Spitzbergen, only heard thunder once during the whole period. These storms are less common in Ireland than in England, because the weather there is cooler in summer than it is here; and Sir John Herschel tells us that they are far rarer in Cape Colony, than in Natal, because the former is a dry district, the latter well watered.

Ever since Franklin, in 1752, flew a kite during a thunder-storm, and drew sparks from a key tied on the end of the string, the fact of the phenomenon being electrical has been recognised. The effects of lightning on the human system are all reproduceable in kind, though happily not in degree, by means of strong electric shocks. Only a year after Franklin's discovery, the first noble victim fell to the resistless power of the lightning flash. Professor Richman, at St. Petersburg, had erected an apparatus for experimenting on the question. He saw a thunder-storm coming on, went home, and on entering his study, went over to the conductor of the machine, when a ball of fire leaped to his head and he fell dead to the ground. Long before this time, at Duino Castle, on the Adriatic, experiments of the nature of Franklin's had been performed. A bar of iron was placed in an upright position, and whenever a storm appeared to be coming on, the sentinel on duty was bound to present to its end his iron halbert. If a spark passed from one to the other, the alarm bell was sounded.

Electrical effects of a very remarkable nature have been observed on mountains, just before a storm. In 1762, Saussure, Pictet, and Jallabert were upon the Brevin, in Switzerland, and they observed flashes darting from their bodies, attended by a crackling sound. Jallabert heard a buzzing sound about his hat, which had a gold band; on placing it on his companions' heads they heard the same sound, and sparks were obtained from it. After loud thunder and heavy rain the storm passed off, and with it the remarkable charge of electricity in the air.

The greatest experimenter on atmospherical electricity was Mr. Crosse, who had a number of conductors erected in his park, in the west of England, connected by wires with an apparatus in his house. During a severe storm he has observed a continuous stream of fire passing from the knobs at the end of his machine, while the windows of the room in which it was placed vibrated constantly, as if every pane must be shattered.

Lightning, whenever we see the actual flash, is usually forked, as the fluid finds its way along the particles of air which afford it the readiest passage, and these do not lie in a straight line. Sheet lightning is only the reflection of a storm at such a distance that the thunder cannot be heard. The reason of the rolling of thunder is to be sought for in the clouds, which produce the echoes. Two gentlemen were out once in a thick cloud, in Switzerland, on one of the mountains. They chanced to fire a shot, and were surprised to hear a roll like the noise of thunder. On repeating the experiment with the like result, they went on till they got out of the cloud, and then no echo followed the report.

Thunder-storms always arise from the mixture of cold and warm air, and accordingly, when they come on during a hot summer's day we see them work up against the wind, being actually caused by a cold wind forcing its way into the warm air near the earth's surface. The thunder-clouds are, however, seldom close to the ground, but drift clear over the summits of the highest mountains. Many travellers tell us that they have seen thunder-storms below them when they were high on the mountain sides, but on inquiry it will always almost be found that the clouds were seen on adjacent mountains, so that their height above the valley has been probably miscalculated. Professor Dove one day ascended the Brocken in a thunder-storm, and was greeted on reaching the inn at the summit, by a party who had gone up some hours sooner, and who assured him that the storm had been under their feet. The professor pointed to the ground outside the inn, which was soaked with rain, and asked whether the rain had come upwards, or had fallen from clouds above them. Lightning, however, does

sometimes ascend, and a melancholy occurrence at Malvern, some forty years ago, was clearly proved to have been caused by it. A party took refuge from a storm in a hut roofed with iron, on a hill-side. A gentleman standing at the door, saw a ball of fire coming towards him along the ground, it knocked him down, killed two of the party in the hut and seriously injured the others.

We have said that thunder-storms are caused by the mixture of two different currents of air; this shows us that the air must be in motion, or that there must be wind. In fact, serious squalls with hail-showers are among the most common accompaniments of a summer storm. The severe storms of August 19th, 1867, and of May 28th, 1868, were both preceded a few hours by a sudden gale on the west coast. The French have long recognised that the barometer falls slightly before such a storm, so that its approach can be foretold with some certainty, while the adoption of lightning conductors has enabled us to some extent to protect buildings and ships from its effects.

THE HEAVIEST WATER.

THE wonder is, not that we die but that we live; for life seems strung upon so many threads, and each so frail that if we know the threads and their frailty we cannot help trembling even in life. But how is the wonder heightened when we may say this of a world; that even the very habitability of our country is dependent upon what may well be called, in comparison to the other vast laws, a mere thread.

Each of our readers must be well aware of the universal law that *heat expands all bodies*, and of necessity, that cold contracts them. Every-day life is full of illustrations of the working of this law. There is not a wind that blows which is not caused by the heated and expanding air in some locality rising, while the cooler and denser atmosphere rushes in to fill its place, and so the wind blows.

The wearied traveller in vain tries to sleep in the train, for as often as he rests his head against the woodwork of the carriage, so often does the jolting wake him. "Why cannot they make the rails dove-tail into each other?" he asks, again and again. But the great law forbids; for, if the iron rails touched each other, the first warm day each would expand a little, and in many miles yards would be added to the line; so the rails would rise from the sleepers and no train could run with safety.

In every large structure of metal allowance has always to be made for the expansion and contraction due to a change of temperature. At page 195 of our work an example is cited of the practical use which has been made in straightening crooked walls by the powerful contracting force of cooling iron. To this otherwise universal law there is but *one* exception—apparently so small, so insignificant in itself, and yet our existence depends upon it—water disobeys the law, but only for the short space of 7½ deg. Fahrenheit, or nearly one-thirtieth of the alteration of temperature between the boiling and freezing of water.

Suppose we have a long tube of water in a room, the temperature of which is that of an ordinarily mild day, about 60 deg. Fahrenheit, and suppose we have the means of causing the temperature of the room to fall gradually till the freezing point of water is reached, which is 32 deg. Fahrenheit. The water in the tube will gradually contract, obedient to the great law, until it reaches the temperature of 37½ deg. Fahrenheit, and then, instead of still contracting, as every other liquid in the world would have done, it begins to expand, and continues to do so until it reaches the freezing point and turns to ice. Thus we see that at the temperature of 37½ deg. the water occupied the smallest possible space, or, in other words, the water had reached its point of maximum density, or of greatest heaviness, and that ice, having a larger bulk weight for weight than this water, therefore swims. Suppose this had not been the case, and that the great contracting law had been permitted to carry on its work: ice would then have been heavier than water and would have sunk. The summer's sun would never have been able to melt the winter's work, and each succeeding winter would have added to the last season's ice, and the accumulation would have proceeded until at length England would have been an icebound and uninhabitable land.

But more wonderful still, as light traverses a transparent medium of a different density to that through which it has passed, its course is changed, and the alteration in its path is more marked the denser the new body. Now should we not expect to find, that since the water at 37½ deg. had reached its greatest possible density, that its refractive power on the light could not be increased? But strange to say, although the water in its expansion has been disobedient to the law, yet light seems to have excused the deviation, and its own refraction goes on increasing as though the ordinary law were being obeyed and the water were still contracting and becoming more dense.

There cannot, in the whole range of science, be produced a stronger proof that this world has an Omniscient Director. We stand as we look at the little isolated fact—so small, so seemingly insignificant—and we can only wonder at the hand which rescued the water from obeying his own great law to the detriment of the world.

EFFECT OF THE ERUPTION OF VESUVIUS UPON THE SEA.

VOLCANOES UNDER WATER.

In November, 1867, a volcano suddenly began to show signs of activity beneath the deep sea of the Pacific Ocean. There are some islands nearly 2,000 miles to the east of Australia called the Navigator's Group, and there had been no history of an eruption amongst them, nor had such an event been handed down by tradition. Most of the islands in the Pacific Ocean are old volcanoes, or are made up of rocks cast forth from extinct burning mountains. They rise up like peaks through the great depths of the ocean, and the top, which just appears above the sea-level. is generally encircled by a growth of the coral insect. Hence they are termed coral islands. These islands every now and then rise higher than the sea-level, owing to some deep upheaving force, and then the coral is lifted up above the water, and becomes a solid rock. But occasionally the reverse of this takes place, and the islands begin to sink into the sea, owing to a force which causes the base of the submarine mountain to become depressed. Sometimes they disappear. All this shows that some great disturbing forces are in action at the bottom of the sea, and just within the earth's crust, and that they are of a volcanic nature. For some time before the eruption, earthquakes shook the surrounding islands of the Navigator's Group, and caused great alarm, and when the trembling of the earth was very great, the sea began to be agitated near one of the islands, and vast circles of disturbed water formed. Soon the water began to be forced upwards, and dead fish were seen floating about. After a while, steam rushed forth, and jets of mud and volcanic sand. Moreover, when the steam began to rush up out of the water, the violence of the general agitation of the land and of the surface of the sea increased. When the eruption was at its height, vast columns of mud and masses of stone rushed into the air to a height of 2,000 feet, and the fearful crash of masses of rock hurled upwards and coming in collision with others which were falling, attested the great volume of ejected matter which accumu-

lated in the bed of the ocean, although no trace of a volcano could be seen above the surface of the sea. Similar submarine volcanic action has been observed in the Atlantic Ocean, and crews of ships have reported that they have seen in different places sulphurous smoke, flame, jets of water, and steam, rising up from the sea, or they have observed the waters greatly discoloured and in a state of violent agitation, as if boiling in large circles.

New shoals have also been encountered, or a reef of rocks just emerging above the surface, where previously there was always supposed to have been deep water. On some few occasions, the gradual building up of an island by submarine volcanoes has been observed, as that of Sabrina in 1811, off St. Michael's, in the Azores. The throwing up of ashes in that case, and the formation of a conical hill 300 feet high, with a crater out of which spouted lava and steam, took place very rapidly. But the waves had the best of it, and finally washed Sabrina into the depths of the ocean. Previous eruptions in the same part of the sea were recorded as having happened in 1691 and 1720.

In 1831, a submarine volcanic eruption occurred in the Mediterranean Sea, between Sicily and that part of the African coast where Carthage formerly stood. A few years before, Captain Smyth had sounded the spot in a survey of the sea ordered by Government, and he found the sea-bottom to be under 500 feet of water. On June 28, about a fortnight before the eruption was visible, Sir Pulteney Malcolm, in passing over the spot in his ship, felt the shock of an earthquake as if he had struck on a sandbank, and the same shocks were felt on the west coast of Sicily, in a direction from south-west to north-east. About July 10, the captain of a Sicilian vessel reported that as he passed near the place, he saw a column of water like a waterspout, feet high, and 800 yards in circumference, rising from the sea, and soon after a dense rush of steam in its place, which ascended to the height of 1,800 feet. The same captain, on his return eighteen days after, found a small island twelve feet high, with a crater in its centre, throwing forth volcanic matter and immense columns of vapour, the sea around being covered with floating cinders and dead fish. The eruption continued with great violence to the end of the same month. By the end of the month the island grew to ninety feet in height, and measured three-quarters of a mile round. By August the 4th it became 200 feet high and three miles in circumference; after which it began to diminish in size by the action of the waves. Towards the end of October the island was levelled nearly to the surface of the sea.

The submarine volcano must have been formed by ejections under water, which collected and attained a height of 500 feet. Then they became visible, and the hill grew in breadth and height, until at last a great conical mountain started from the deep sea and reached upwards into the air to 200 feet. Shoals still exist where the mountain once was, so that its base and some 400 feet of it still remain under the water.

The illustration on the preceding page shows the submarine volcanic action which has been observed in the bay of Naples during an eruption of Vesuvius.

REMARKABLE ECHOES.

In the sepulchre of Metella, the wife of Sulla, in the Roman Campagna, there is an echo which repeats five times, in five different keys, and will also give back with distinctness a hexameter line which requires two and a half seconds to utter it. On the banks of the Naha, between Bingen and Coblentz, an echo repeats seventeen times. The speaker may scarcely be heard, and yet the responses are loud and distinct, sometimes appearing to approach, at other times to come from a great distance.

Echoes equally beautiful and romantic are to be heard in our own islands. In the cemetery of the Abercorn family, at Paisley, when the door of the chapel is shut the reverberations are equal to the sound of thunder. If a single note of music is breathed, the tone ascends gradually with a multitude of echoes, till it dies in soft and bewitching murmurs. In this chapel is interred Margery, the daughter of Bruce, and the wife of William Wallace.

The echo at the "Eagle's Nest," on the banks of Killarney, is renowned for its effective repetition of a bugle call, which seems to be repeated by a hundred instruments, until it gradually dies away in the air. At the report of a cannon, the loudest thunders reverberate from the rock, and die in seemingly endless peals along the distant mountains.

At the Castle of Simonetta, a nobleman's seat about two miles from Milan, a surprising echo is produced between the two wings of the building. The report of a pistol is repeated by this echo sixty times, and Addison, who visited the place on a somewhat foggy day, when the air was unfavourable to the experiment, counted fifty-six repetitions. At first they were very quick, but the intervals were greater in proportion as the sound decayed. It is asserted that the sound of one musical instrument in this place resembles a great number of instruments playing in concert. This echo is occasioned by the existence of two parallel walls of considerable length, between which the wave of sound is reverberated from one to the other until it is entirely spent.

Wonders of Animal

A WONDERFUL WORM.—There is a kind of sponge which grows in the depths of the Mediterranean Sea, and in its tissues a most wonderful is found. This Syllis, as it is called, has a blunt head, a long body, and is marked with rings like other worms; it has a number of short legs sticking out from the rings and covered with bristles. The worm buds like a plant, and each bud turns to a worm like the parent. Hundreds of these buds occur on the head and on the two legs nearest the neck, and they speedily grow into long ugly things, which in their turn will produce buds and new crops of worms. When these budding young worms are nearly full grown, the parent appears to be very tired of their company, and wriggles about and endeavours to move backwards so as to leave its attached children behind. Considering that all these worms produce eggs, which when hatched become worms, and that every individual produces others by budding also, there can be no doubt that nature has some good reason for placing a vast number of these creatures on a certain spot during a short time. Probably there are many fish that consume the majority of these young worms before they have been a long time separated from their parent.

SPIDER SILK.—Reaumur found that 2,304 silkworms will produce one pound weight of silk; and as he considered the work of twelve spiders only equal to one silkworm, a pound of silk would require the labours of 27,648 spiders. Each thread of spider's web contains 5,000 separate fibres. The male spiders are not workers; so that in order to get enough silk from the web that encloses the eggs of the female, 55,296 spiders would have to be kept. How many flies?

SPOTS ON THE SUN.

IT seems strange to say that the geography of the moon, or at least of much of that portion of her surface which is presented to our view, is better known than that of many parts of our own earth; and yet this is quite true. Our telescopes are of such power that if there were an object on the moon's surface as large as the Crystal Palace, they would infallibly reveal it to us, and so the astronomer would be able, if not to "visit it," at least to "give it a name, and get it at last into guide-books," as Clough says in the "Bothie." Most elaborate maps of the moon have been made, and it has been satisfactorily proved that she herself is a solid body, probably composed of rocks much like those on our planet, but not provided either with water or with any trace of an atmosphere.

About the sun's geography we know much less; in fact, we can hardly see the sun himself at all, for the solid core is surrounded by a sort of atmosphere called the "photosphere," or light-sphere, whence it is, on good grounds, believed that the heat proceed.

When we come to examine the sun by the aid of a telescope, we find that all parts of the surface do not give out light to the same extent, and that there are certain places on it darker, and some than the remainder of the disc. The former are called *sunspots*, the latter *faculæ*, which are always associated with spots.

The first person who examined sunspots closely was the illustrious Galileo, who proceeded to determine from them the sun's velocity of rotation on his axis; for he perceived that they moved across the sun's body. However, since his time, it has been shown that the spots have a motion of their own; those at the sun's equator moving faster than those at his poles; so that observations on the spots alone cannot tell us the rapidity of the revolution of the sun's entire mass. It has also been noticed that the number of these spots visible at one time does not remain the same from year to year, and, in fact, that about every ten years there is an epoch at which they are especially abundant. General Sabine has pointed out that these periods of frequency of sunspots are coincident with the periods of greatest magnetic disturbance on our own globe. Accordingly, we see that there exists a distinct and close connection between variations in the appearance of the sun, and changes in the physical constitution of our earth.

The interesting question now arises: *What are the sunspots? and what is their cause?* The very careful investigations carried on at Kew Observatory for some years by Messrs. De La Rue, Stewart, and Loewy, have thrown much light upon this interesting subject.

One of the most remarkable features of the spots is, that their central portion is darker than the edge; and accordingly, nearly a century ago, Alexander Wilson, of Glasgow, had suggested that they were pits in an envelope which surrounded the sun. The results of the Kew experiments seem to confirm this idea. They further go to show that the faculæ, or bright patches, are really of the nature of luminous clouds, placed, relatively to the sun, above the level of the spots. These faculæ are generally seen behind the spot, a position which they would necessarily assume if they were thrown up to a greater distance from his centre, and would move more slowly. The same observers have shown that spots are produced *below* the level of the sun's photosphere, while the faculæ are suspended *in* that medium. If this be admitted, it seems to follow that the two phenomena are effects of a vertical circulation in the gaseous matter surrounding the sun, the faculæ being produced

when a portion somewhat denser than the medium in which it is suspended is raised into or above the photosphere, while spots are observed when such a mass is below the photospheric stratum. In fact, Mr. Lockyer, one of our most diligent sun observers, has seen a facula, apparently in the act of sinking, lose its brightness and gradually pass into a spot, its form remaining unchanged during the process. The same gentleman has been recently engaged, with most brilliant success, in the investigation of the constitution of the photosphere itself, but on this subject we cannot enter in the limits of the present paper.

The labours of Messrs. De La Rue and Stewart have thrown some light on the possible causes of the vertical circulation in the solar atmosphere. We have already alluded to the ten-yearly periods of frequency of the spots. These gentlemen have discovered that there is a shorter period of twenty mont[illegible]luration observable in the recurrence of spots, and that this coincides with the periods of recurrence of the same relative position of Venus as regards the sun and the earth. A similar relation between Jupiter and the sun is also indicated. These discoveries are of the very greatest interest, as they show us how intimately all the bodies of our solar system are related to each other, and how the slightest change in any one of them exerts a definite influence on the condition of the entire system, despite the great magnitude and the distance from each other of the bodies which compose it.

INDIAN JUGGLERS.

THE jugglers of Madras are famed all over the world. A person of this description, but of a higher native caste, a Cuddapah Brahmin named Sheshah, in 1828, appeared seated in the air, apparently without any support—an exploit which he performed with great success. In person he was a slender, middle-sized man, and had attained a considerable age. He wore a long chintz gown, a yellow-dyed turban, and a high waist-band. Around his neck was suspended a row of large beads. A person who witnessed the performance says, "He exhibited before me to examine a stool about eighteen inches in height, on the seat of which were two brass stars inlaid, somewhat larger than a dollar. He then displayed a hollow bamboo, two feet in length, and two and a half inches in diameter. The next article was a roll of antelope skin, four inches in circumference and two feet in length. The man then concealed himself in a large shawl, with these three articles and a large bag. After a delay of five minutes, during which he appeared very busy under the shawl, he ordered the covering to be taken off him, and he was discovered actually sitting cross-legged in the air, but leaning his right arm on the end of the antelope skin, which communicated horizontally with the hollow bamboo, which again was connected perpendicularly with the stool immediately over one of the brass stars. He sat for more than half an hour, counting his beads in his right hand, and as calmly as if this new mode of sitting was no exertion to him. A large bribe was offered to induce him to reveal his mode of performance, but he declined to explain the secret. It has been thus accounted for:—The brass stars conceal a receptacle for a steel bar passing through the hollow bamboo; the antelope skin conceals another steel rod, which is screwed in the one in the bamboo; other machinery of the same kind passes through the man's sleeves and down his body, and supports a ring on which he sits." A small cut of this feat appears on page 326.

The bodies of some of the jugglers are so lithe and supple as to resemble those of serpents rather than men. Swallowing the sword is a common feat with them; others walk upon thin linen cloth, stretched out slightly in the hands of four persons, without ruffling it or forcing it from the grasp of the holders. Some of the optical deceptions are exceedingly curious, and inquirers are to this day provoked to guess how plants and flowers can be instantaneously produced from seeds. The Madras jugglers travel to all parts of India, but it is not often that the most celebrated are to be met with at a distance from the theatre of their education.

An exhibition of Indian jugglers took place in London from 1810 to 1815, and was very popular. Upon a raised platform the chief performer took his seat, and behind him sat the second juggler, with an attendant boy to beat two cymbals and at the same time utter an unremitting sound like the clucking of a hen.

The first tricks were performed with cups and balls, with great dexterity. The cups seemed enchanted; the balls flew, they increased in number, they diminished, now one, now two, now none, under the cup. And now the serpent, the cobra di capella, usurped the place of a small globule of cork, and wound its snaky folds as if from under the little vessel. During his performance the juggler kept up an unremitting noise, striking his tongue against his teeth, like the clack of machinery, and uttering sounds as if he were repeating with inconceivable rapidity the words "Crickery-tick," "atow," "gerat-tow," &c.

The next feat was that of breaking a cotton thread into the consistency of scraped lint, as used by surgeons, and reproducing it continued and entire. The juggler then lays in the palm of his hand a small quantity of common sand, which by rubbing with his fingers he changes in colour—the colourless grains become yellow; he rubs them again—they are white; again, and they are black.

Next was a series of evolutions with four hollow

GROUP OF INDIAN JUGGLERS.

brass balls, the size of oranges. His power over these was almost miraculous. He caused them to describe every possible circle, horizontally, perpendicularly, obliquely, transversely; round his legs, under his arms, about his head, in small and in large circumferences, with wondrous rapidity, and keeping the whole number in motion at the same time.

He then exhibited his astonishing capability of balancing. He placed on his two major toes a couple of thin rings, four inches in diameter; a pair of similar rings he placed on his forefingers, and then he set the whole in motion, when round they whirled, and continued describing their orbits without cessation, as if set to work by machinery, to realise the problem of perpetual motion. Throwing himself back, the juggler then balanced a sword upon his forehead, and with his mouth strung a number of very small beads upon a hog's bristle, which he held between his lips. All the rings were kept in regular motion, the sword was nicely poised, and the bead-stringing carried on, of necessity, in quiet.

The juggler then executed this exploit:—Upon the tip of his nose he balanced a small wooden parasol, from the circumference of which about a

dozen of cork tassels were pendent. With his mouth he inserted into each of these tassels a quill about twelve inches long, the thickness of that of the porcupine. The bases of these he placed with his tongue between his upper lip and nose, the rings on his toes all this time performing their circuits. Having put a quill into every tassel, he took out the centre stick on which the parasol was originally supported on the tip of his nose, and it then remained balanced on the quills. Thus far the work was difficult enough, but he then undermined the supports by a quill at a time till only three remained. Of these he took one away, and the top, which resembled the roof of a pagoda, swung down and hung by two, the juggler preserving the balance even throughout the motion; the last prop but one was then removed, and on that one the erect balance of the machine rested.

After other extraordinary performances the juggler placed a stone of about fourteen pounds weight, resembling in size and shape a Dutch cheese, between his feet. With an apparently slight exertion with his heels he threw up the stone, which performed a

parabola over his head from behind, alighting upon the bend of his arm, where it rested. He then tossed it to the same part of the other arm, where it also rested, as if held by the hand; thence he threw it to various parts of his frame—to his wrists, and the back of his neck. He again tossed it to his arm, back again to his neck, and finally, by a masterly jerk, threw the stone of fourteen pounds weight *round his head!*

The famous feat of *swallowing the sword* closed this wonderful exhibition. Being performed by a juggler, most persons supposed there to be some deception in the feat; but this was not the case, for this wonderful man actually and before your eyes, palpably and fairly thrust a spit, of nearly an inch in breadth and twenty in length, down his throat into his belly, and there left it sticking, with the handle, which was solid, and not thicker than a lady's little finger, and therefore not capable of favouring any trick, held by his mouth. He then drew the sword from this odd scabbard, made his obeisance, and the performance ended.

Curious Calculations.

CONSUMPTION OF AIR IN ACTIVITY AND REPOSE.—Dr. Radclyffe Hall makes the following interesting statement with regard to the amount of air we consume in repose, and at different degrees of activity. When still, we use 500 cubic inches of air in a minute; if we walk at the rate of one mile an hour, we use 800; two miles, 1,000; three miles an hour, 1,600; four miles an hour, 2,300. If we run at six miles an hour, we use 3,000 cubic inches; trotting a horse, 1,750; cantering, 1,500.

THE VALUE OF LABOUR.—Cast iron of the value of £1 sterling is worth, converted into ordinary machinery, £4; in larger ornamented work, £45; in buckles and similar kinds of fancy work, £600; in neck chains, £1,300. Bar iron of the value of £1 sterling is worth, in the form of knives, £36; needles, £70; penknife blades, £950; polished buttons and buckles, £890; balance springs of watches, £5,000.

INTEREST OF MONEY.—Dr. Price, in the second edition of his "Observations on Reversionary Payments," says:—"It is well known to what prodigious sums money improved for some time at compound interest will increase. A penny so improved from our Saviour's birth, as to double itself every fourteen years—or, what is nearly the same, put out at five per cent. compound interest at our Saviour's birth—would by this time have increased to more money than could be contained in 150 millions of globes, each equal to the earth in magnitude, and all solid gold. A shilling, put out at six per cent. compound interest would, in the same time, have increased to a greater sum in gold than the whole solar system could hold, supposing it a sphere equal in diameter to the diameter of Saturn's orbit. And the earth is to such a sphere as half a square foot, or a quarto page, to the whole surface of the earth."

RESISTLESS FORCE OF GROWING TOADSTOOLS.

FOUR years ago a portion of the pavement in the Goswell Road, London, was heaved out of its place in a mysterious manner. Before it could be replaced, numerous toadstools made their appearance in the gaping spaces between the stones. When the stones were removed it was found that they rested over an immense spongy mass of toadstool growth, which had gone on increasing until it made a way through which it could push its head into the air. One of the stones raised by it measured four feet by two feet, and weighed two hundredweight. A more extensive injury was done in the same way some years ago at Basingstoke. Not many months after the town had been paved, the pavement was noticed to exhibit an unevenness

which could not be accounted for. As soon, however, as the unevenness was sufficient to make openings between the stones, the hidden enemy made his appearance in the shape of innumerable toadstools. So completely had the spores or spawn got possession of the material on which the pavement was laid, that it had to be completely taken up, and the whole town had to be repaved.

The toadstool and its kind seem to flourish in places where the light is excluded, as in dark cellars, under flagstones, and in hollow trees. They require, however, the air, and a certain, though it may be a small, amount of light, that they may reach their perfect condition. Unless they are able to produce seed, they go on developing this amorphous spongy mass, until it attains sometimes a fabulous dimension. Every one has heard of the enormous growths of fungi in some wine-cellars. A case is on record in which a cask of wine, having been left without attention for three years in a dark cellar, was at the termination of that period found to have been borne on the surface of a mushroom growth until it was forced against the roof. The fungus, moreover, had got access to the wine, and had drunk it all, living upon its sugar, and so the more easily raising the gradually emptying cask from the ground. Fungi have, sometimes, taken possession of worked-out mines, and occupied enormous spaces.

THE BRITANNIA BRIDGE.

THIS structure consists of two rigid tubes of iron placed side by side, 9 feet apart, resting upon three stupendous towers of masonry, the centre one being 20 feet higher than the Monument, and connecting by a continuous double line of railway the coast of North Wales with the Isle of Anglesey. Each entire tube is 1,511 feet long, originally constructed in four pieces, the whole being afterwards united into one. The great tubes were 460 feet long, and the smaller 230 feet, united in the several towers by shorter tubes which filled in the gaps. They were constructed upon the beach adjoining on strong timber stagings, covering nearly three and a half acres, and containing upwards of 110,000 cubic feet of timber. This staging was liable to destruction, from the falling of the red-hot rivets employed in binding the plates of the tubes together; and to prevent an outburst, two fire-engines were kept at hand in constant readiness. The level of the staging was slightly above that of high spring-tides, so that the great pontoons or barges intended to convey the tubes to their destinations could be floated under them at the rise of the tide, and lift them bodily off.

The tube is a built-up structure of wrought iron, the iron being employed in the form of plates, angles, and rivets. The four middle tubes each weigh 2,000 tons, and the entire weight of all the tubes, including the rails, is 10,540 tons. In their construction, 83 miles of angle-iron are employed for strengthening and stiffening the plates, and the whole is bound together by more than 2,000,000 rivets, to receive which 7,000,000 holes had to be pierced in the iron, of which latter there are 186,000 separate pieces. All these figures are on so gigantic a scale that it is difficult to realise their magnitude.

The mass of iron in the tubes would weigh down a solid iron ball whose diameter is 45 feet, which is higher than the generality of houses. Taking the rivets at the average length of 3½ inches, the two millions employed would, if placed end to end extend in a line 110 miles long.

The form of the tube is shown in Fig. 1, which represents a portion of the top and bottom floors, and their connection with the side. It will be seen that these floors are cellular, this mode of construction having been decided upon to gain strength, after a prolonged series of experiments extending over fourteen months. A slight difference exists in the dimensions of the cells in the top and bottom floors. Their height is the same, but the breadth of the lower ones is greater, and the cells consequently fewer. It has been proved by experiment that the strength of the upper floor should be the greater, and from it the lower floor is, as it were, suspended by the sides. These latter are strengthened by the angle-irons A, A, and by a vertical rib or angle-iron, B, extending from the top to the bottom. The cells are made large enough to admit a man, for the purpose of painting or repairing them.

The furnaces for heating the rivets were forty-eight in number, and each furnace could heat 1,000 a day. Constant practice enabled the boys who attended the rivetters to throw the red-hot rivets a height of thirty-three feet with almost unerring precision, and about 8,000 rivets a day were driven in.

The pontoons, or barges upon which the tubes were floated to the towers, were 98 feet long, 25 feet broad, and 8 feet deep, and when loaded to the water's edge would each support a weight of 460 tons. They cost £1,500 each. The floating of the tubes, and the guiding them to their ultimate positions below the towers, was a process of great difficulty. The tides in the Menai Straits run furiously fast, and only a short interval elapses of comparatively quiet water. One of the Anglesey tubes was the first floated, and in course of piloting it an eight-inch hawser snapped like pack-thread under the pressure of the tide upon the pontoons. One great capstan was torn bodily from its seat, and the tube only arrested from being dashed upon the Britannia Rock by the spare end of the huge

cable, twelve inches round, which was thus left free, being seized hold of by the crowd of spectators thronging the beach.

The tube, after having been guided into its place, reposed upon the bed prepared for it above the reach of the tide for fifty days, during which period the hydraulic presses and lifting-chains were being prepared and fitted near the summit of the towers. Three presses were employed, one large one having a "ram" or plunger twenty inches diameter, placed in the Anglesey Tower, and two smaller ones, having each 18-inch rams, fixed in the Britannia Tower. The pressure of water was three tons upon a circular inch, and it was forced in by a steam-engine of 13½ horse-power. These presses had a "lift" of six feet, which was equal to one link of the suspending chains, and at the end of each lift the chain was gripped by a strong clamp, and the brick-work of the tower filled in under the tube; the presses were then lowered and attached to the next link of the chain, and a fresh hoist of six feet made. The enormous pressure of water actually drove the fluid through the pores of the iron, and a gruel of oatmeal and sal-ammoniac was forced into the iron, and allowed to harden, by which much of the leakage was prevented.

Upon one occasion, the tube having attained a height of 24 feet, the bottom of a press was forced out by the pressure, and the mass of iron, weighing 2½ tons, fell from a height of 60 feet upon the top of the tube, striking down a sailor who was ascending the tower by a ladder, and seriously damaging the tube. Upon another occasion, a severe frost caused the water in the presses to freeze, and the expansion caused by it actually lifted the ram, with its cross-head and chains weighing more than 100 tons, through a space of one inch and a quarter. After this, fires were kept under the cylinders. The tubes are now 103 feet clear of the water at high tide.

The effect of a gale of wind upon the tube is considerable; it is estimated as exerting a pressure of 277 tons, and this was very evident whilst the tube was being raised and depending from the chains, causing it to oscillate like a pendulum against the sides of the masonry. The larger tubes bent in the middle by their own weight, resting upon the ends, 12 inches; but after all the tubes were connected in one length this deflection was diminished, and the variable bending of the tubes under the weight of the heaviest goods trains is under half an inch. It is estimated that a weight of 1,792 tons may be safely suspended from the centre of either of the tubes, and double this if the weight be distributed over its length. Thus one of the tubes would almost bear another laid across its centre.

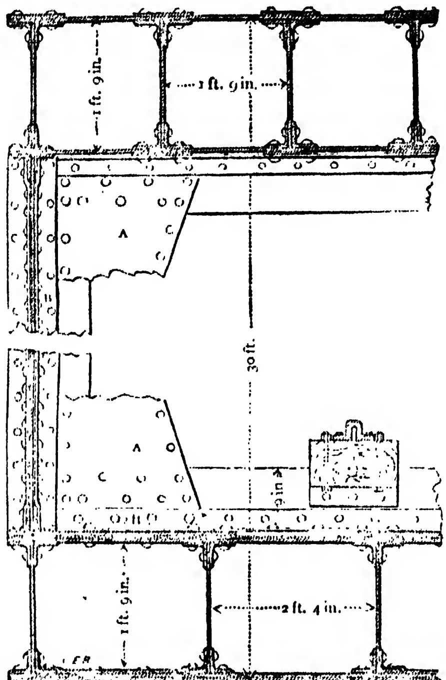


Fig. 1.

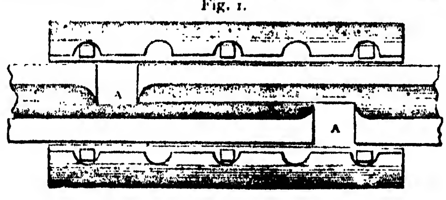


Fig. 2.

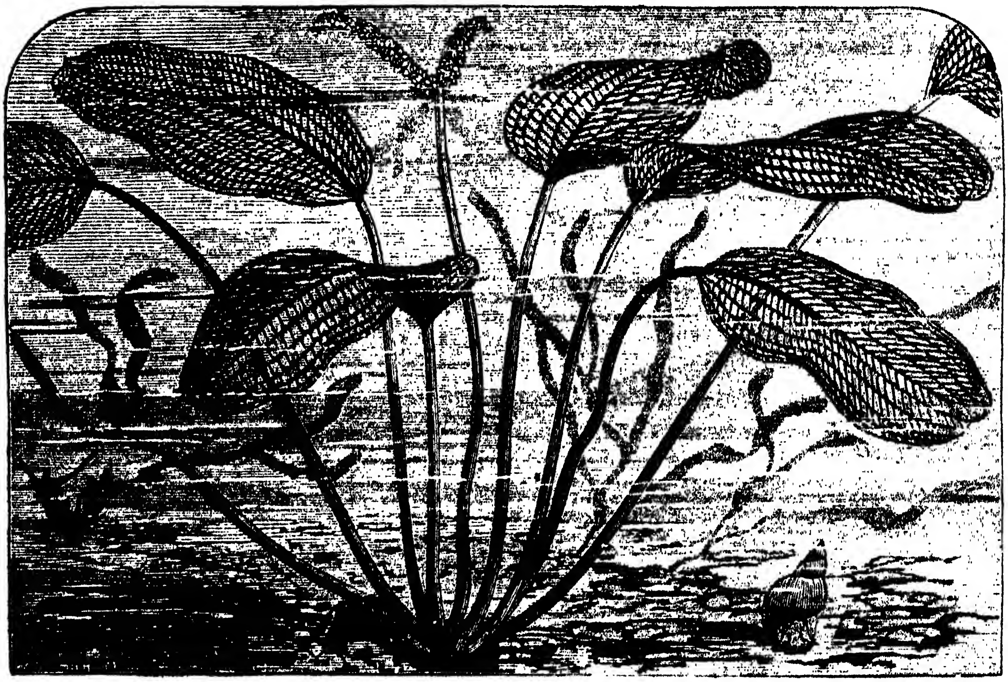
The tubes expand and contract under the influence of heat, to a great extent. They are fixed only in the centre tower, and rest upon a bed of rollers in other places. The expansion is, therefore, visible at both ends to the extent of half the whole. Sunshine has a marked effect upon the tubes; falling only upon the top and one side, it expands those faces only, causing them to curve towards the sun to the extent often of 2½ inches. Passing clouds obscuring the sun temporarily reduce the deflection, but even upon a cloudy day, when the sun is wholly obscured, the solar heat is proved to pass through the clouds by its effect upon the tubes.

The cells in the roof and floor form excellent speaking-tubes, and conversation can be easily carried on across the whole length. The inside of the tubes is wide enough to allow a man to stand whilst a train is passing.

An ingenious sliding rail, shown in Fig. 2, is fixed at the extremities of the tube, to allow of a continuous road-way under all effects of contraction of the tube. The two adjoining rails are divided where they overlap, as seen at A, the two flat sides sliding by one another, and thus the wheels of the trains have always a continuous bearing. The entire cost of the Britannia Bridge, preliminary experiments included, was £601,865.

THE LATTICE PLANT.

About seventy years ago a French botanist collected in Madagascar specimens of this singular plant, but for more than fifty years no living specimens were brought to Europe. The Rev. William Ellis, whose connection with Madagascar has produced marvellous changes in the past, and will influence all its future history, brought from that island the first living specimens some fifteen years ago, and now it is to be found in most botanic gardens and in many private collections. It grows without much trouble, and in a short time will be an ornament in the windows of every cottager or artisan who is fond of plants.



THE LATTICE PLANT (*Ouvirandra fenestralis*).

There is little of interest in the inconspicuous flowers, but it would be difficult to imagine anything more delicate and beautiful than the exquisite network of the leaves.

The plant grows under water near the margins of running streams. Its thick root, or rather, horizontal stem, creeps along the surface of the mud, throwing out long, fine roots below, and at intervals, on its upper surface, clusters of leaves. The leaves are supported on stalks which are long enough to bring them just under the surface of the water, where they are spread out more or less horizontally. The leaves are of an oblong form, nine or ten inches long, and two or three inches broad. They have a strong mid rib. but the remainder of the leaf is like a living fibrous skeleton, formed by the interlacing of two sets of veins. The one set are longitudinal, and nearly parallel to the mid rib and the margin of the leaf; the others spring from the mid rib and pass outwards towards the margin, crossing the longitudinal series at right angles, and forming quadrangular meshes.

Leaves, as a rule, are composed of numerous veins, with cellular matter spread out between them, and uniting them so as to form a flat continuous surface. The leaf of the lattice plant seems as if it were composed entirely of the veins; but when a leaf is examined by the microscope it is seen that the delicate veins are surrounded by a layer of cells. These cells are more numerous in some leaves which have the meshes oval—this form being produced by the filling up the angles of the ordinary form of mesh. Leaves are also occasionally found in which the meshes are entirely filled up, so as to form a perfect blade.

At first the leaf is of a pale yellowish colour; in the several stages of its growth it passes through every gradation of colour, from that named to a dark olive, becoming, before it finally decays, brown or nearly black.

Mr. Ellis thus describes the aspect of the living plant:—"It is scarcely possible to imagine any object of the kind more attractive than a full-grown plant, with its dark green leaves forming the limit of a circle two or three feet in diameter, and pre-

senting in the transparent water, within that circle, leaves in every stage of development, both as regards colour and size. Nor is it less curious to notice that these slender and fragile structures, apparently not more substantial than the gossamer, and flexible as a feather, still possess a tenacity and wiriness which allows the delicate leaf to be raised by the hand to the surface without injury."

The beauty of the growing plants is greatly enhanced by the innumerable bells of oxygen entangled among its meshes, and glittering in the sun, which it has disengaged from the carbonic-acid gas on which it lives.

The flowering stalk rises from the middle of the cluster of leaves. As it pushes itself up to the surface of the water it is covered by a singular little cap, which falls off entire, and liberates the two short and fleshy branches on which the numerous small colourless flowers are borne.

At the period of the year when the thick fleshy root or creeping stem is stored with starch, the natives of Madagascar collect it and use it as an article of food. It is called by them "ouvirandrano," which means water-yam, because when cooked it tastes like the yam. Botanists have adopted the native name for the genus, giving it, in accordance with their invariable practice, a Latin termination— 'ra, and adding *fenestralis* as the designation of the species in allusion to the remarkable structure of the leaf.

THE FIRE OF LONDON.

A FLICKERING, dancing light seen over the tops of the houses of the busy London of 1666; the usual hurrying crowd to look upon the glowing sight; the feeble engines of the day; and the customary crowding and confusion. Rumour, the news-bearer, whispering that the fire was at a baker's shop close to the bridge, and, except in the near neighbourhood, very little notice taken. But a strong easterly wind blowing, the flames were fanned till they roared in the blast; rose up higher and higher, licking up with their myriad tongues the combustible material, and then making a rush to the adjoining premises. And soon rumour, busier than ever, bearing the news to eastward, to westward, and around, that the little fire at the old wooden house had spread, and those on either side were burning; that the flames had leaped across from one low-beamed dwelling to another on the other side of the street; and that, gathering strength moment by moment from that upon which they fed, a whole street was burning; two streets; and the flames growing fiercer, when reverencing nothing in their wild rage, a church had been attacked, and the darting tongues of fire were soon seen curling and higher round the tower till the glare the sky, a storm of sparks flew over the houses, and here and there, in unexpected spots, where, whirled up by the mighty draught caused by the ascending heat, a fragment of burning wood had been thrown, fresh fires began to start into life with a wondrous activity, till the panic-stricken inhabitants of the district commenced hurriedly moving their goods and securing the valuables they possessed from the calamity that threatened.

No need was there for rumour; soon the mighty fire announced itself, roaring and raging like a vast furnace, heating the very atmosphere and sending its glow and a large army of smoke-clouds miles away into the country. The streets thronged with sight-seers or fleeing families; the ways choked with vehicles furniture-laden; and blank faces everywhere listening to the tidings that the engines were useless and had been burned up by the ever-advancing fire. Church after church was now falling a victim to the flames, and continued to fall till one hundred were laid in ashes. As the fire spread, the timber houses flashed into light and disappeared like match-wood, till 13,000 had helped to feed the conflagration, and streets to the number of 400 formed now but rugged choked ways, amidst piles of ashes, crumbling chimneys, and thousands of charred beams, glowing with an intense heat, and at every gust of wind sending up a very storm of golden dancing sparks, to alight upon yet untouched portions of the city.

The great cathedral, even though standing high and massy, did not escape; and in spite of the expectations that the flames would find it invulnerable, it was pierced at last by a spear of flame in the roof, and in its turn was soon a burning fiery furnace, ejecting bursts of golden fragments, and a rain of molten silver, glistening in the light, as its six acres of sheet-lead which covered ridge, roof, and gutter, melted and poured trickling down.

From a wild activity at first displayed, the frightened citizens began to look on the doomed city with stolid apathy. The very thieves were gorged with plunder, while the inhabitants of streets far distant began to flee in dismay as morning after morning brought its news of the rapid approach of the flames. Finding the utter uselessness of the ordinary plans for arresting a fire, the authorities at length, setting at naught the opposition they encountered, adopted extraordinary means, and in all directions where the fire was found to be spreading, houses were blown down, and large gaps made, from out of which everything inflammable was removed. This, save in extreme cases was found to be effectual, and by being carried on energetically, arrested the further progress of the ruin; but for days the vast waste of many square acres was burning fiercely; the flames ceasing and again bursting forth from some pile of smoking ashes; then sinking for awhile perhaps to dart forth again. The heated stones of the streets, and the suffocating, lurid state

of the atmosphere, greatly hindered the efforts of those who were appointed or volunteered to assist; and after the fire had once thoroughly obtained the mastery, but little was done beyond keeping it within the huge bounds which it had marked out.

But a few months and the inhabitants had been fleeing from the plague, and many had hardly returned to their homes before they were once more compelled to flee—to return once more and seek in vain for the very site where their houses had stood. And now, the fiercer part of the excitement over, and the dread of a further spread of the catastrophe at an end, rumour was again busy, but now as to its origin, spreading the news that the city had been fired by the Papists, an idea perpetuated in the inscription to be seen to this day upon the Monument, though the cause was plainly due to the narrow, crooked ways and timber-built houses, so designed that the ignition of one would necessarily have resulted in the fire spreading to many.

However, in spite of its devastating effects, good sprang from the fire, in the shape of wider streets, better sanitary arrangements, and an ever-increasing city, which, if not the handsomest, is certainly one of the most healthy in the world.

Wonders of Science.

A GRAIN OF GOLD has been found by Muncke to admit of being divided into *ninety-five thousand millions of visible parts;* that is, by the aid of a microscope magnifying one thousand times. A sovereign is thus capable of division into ten millions of millions of visible particles, being ten thousand times as many such particles as there are men, women, and children in all the world.

SPONTANEOUS COMBUSTION.—Liebig, in his "Familiar Letters on Chemistry," has proved the unsoundness of spontaneous combustion. Yet Dr. Lindley gives nineteen instances of something akin, or the rapid ignition of the human body by contact with flame as a consequence of the saturation of its tissues by alcohol.

VIBRATIONS OF THE AIR.—If a person stand beneath a railway girder-bridge with an open umbrella over his head, when a train is passing, the vibration of the air will be distinctly felt in the hand which grasps the umbrella, because the outspread surface collects and concentrates the waves into the focus of the handle.

MOTION OF WAVES.—The progressive motion of a wave on the water exactly corresponds in speed with that of a pendulum whose length is equal to the breadth of the wave; the same law, gravity, governs both.

THE EARTH'S CENTRE.—All bodies weigh less the further removed they are from the centre of the earth. A block of stone weighing 700 pounds upon the sea-shore, will weigh only 699 pounds if carried up a mountain three miles high. A pendulum oscillates more quickly at the poles than at the equator, because the earth is flatter by twenty-six miles at the poles—that is, the "bob" of the pendulum is that much nearer the earth's centre, and therefore heavier, and so swings more quickly.

LIGHT OF THE SUN.—A photometric experiment of Huygens, resumed by Wollaston, a short time before his death teaches us that 20,000 stars the same size as Sirius, the most brilliant in the firmament, would need to be agglomerated to shed upon our globe a light equal to that of the sun.

AFRICAN SPIDERS.

LIVINGSTONE was once bitten, when half asleep, by a light-coloured spider. Feeling something running across his forehead, he put up his hand to wipe it off, when he was sharply stung on the hand and head, and the pain was very acute, but it ceased after two hours. The natives declare that there is a small black spider in the country whose bite is fatal, but the great traveller did not meet with an instance in which death could be traced to this insect, though he saw a very large black hairy spider an inch and a quarter long, and three-quarters of an inch broad, which had a hook at the end of its front claws similar to that at the end of the scorpion's tail. When these hooks were pressed the poison came out. There are spiders in South Africa which seize their prey by leaping upon it from a distance of several inches. When alarmed, they can spring about a foot away from the object of their fear. A large reddish spider obtains its food in a different manner from either, by patiently waiting in ambush, or by catching it with a bound. It runs about with great velocity in and out, behind and around, every object, searching for what it may devour, and from its size and rapid motions excites the horror of every stranger. It does no harm to men except to make the nervous, and those that hate spiders, very uncomfortable. This active little insect is very clever, for it imitates the mason-spider, and makes a nest in the earth lined with beautiful soft silk, covered with a nicely-fitting trap-door about the size of a shilling. When this is shut it is so cleverly covered with hard earth that it cannot be distinguished from the rest.

In some parts of the country there are great numbers of a large beautiful yellow-spotted spider, the webs of which are about a yard across. The lines on which these webs are spun are hung from one tree to another, and are as large as coarse thread. The fibres of the web itself are so thick that it is a common thing in walking through the forest to get one's face covered by them like a lady's veil. Another kind of spider lives in society,

brilliantly illuminated, the crystals of rock-salt sparkling exquisitely in the blaze of torches. There is room for at least 1,000 persons to dine in this chamber without inconvenience, and its dimensions are so vast, that despite the number and the brilliancy of the torches, and notwithstanding that the glittering walls and roof tend to reflect the blaze, the eye in vain attempts to fathom its vastness.

The mine is entered by eleven shafts, and the total length of the passages is 270 miles—a distance considerably further than from London to Plymouth.

The value of the mines is very great, and the kings of Poland in former times derived the greater part of their revenues from them, depending entirely upon them for the dowries of their queens. At each election of a king, the nobles exacted the right of taking the salt for their own use, free of all cost, beyond that of the excavation. The yield of the mines is about 60,000 tons a year, about 6,000 persons being employed in them. There is no foundation for the statement that persons are born and die in the mines, without ever seeing the light of day, as the means of egress are such that a person may ascend from the bottom to the top in a very brief space of time. The atmosphere is perfectly healthy, and a stream of fresh water flows through the mine; but the labourers, beyond taking their meals in the mine, never remain down at work longer than they would if employed upon the surface. The horses when once down, remain there until unfit for further service.

SPEAKING MACHINES.

THE speaking machines of antiquity have already been glanced at (see pp. 137-139). The principle of a speaking machine has, however, been developed by the moderns. Bishop Wilkins, in his "Mathematical Magick," illustrating the mode by which articulate sounds may be produced by automata, says, "Walchius thinks it possible entirely to preserve the voice, or any words spoken, in a hollow trunk or pipe, and that this pipe, being rightly opened, the words will come out of it in the same order wherein they were spoken, somewhat like that cold country where the people's discourse doth freeze in the air all winter, and may be heard in the next summer, or at a great thaw; but this conjecture will need no refutation."

Van Helmont, one of the first persons who wrote upon the adaptation of the organs of the voice to the articulations of the letters, considered that the letters of the alphabet constituted the order in which articulate sounds were naturally produced by the structure of the tongue and larynx; that when one letter was uttered, the tongue was in its proper position for the pronunciation of the subsequent one. Thus, as several different sounds are formed by merely raising or depressing the tongue slightly, as in the sounds, *Aw, Ah, Ae, A, E*, it was easy to produce them by means of a tube with a reed, and terminating with a bell. Mr. Willis effected this by using a long tube with a reed, capable of being lengthened or shortened at pleasure. In the pronunciation of the vowels *i, e, a, o, u*, it required to be shortest with the first, and in uttering the subsequent letters to be gradually lengthened. In this way it was easy to measure the length necessary for each note. When *Ae*, was pronounced, the tube was one inch long; *Aw*, 3·8 inches; *Ah*, 2·2 inches; *A*, 0·6 inch; *E*, 0·3 inch.

A speaking machine, invented in Germany, pronounced distinctly, *mamma, papa, mother, father, summer*. The instrument consists of a pair of bellows, to which is adapted a tube terminating in a bell, the aperture of which is regulated by the hand, so as to produce the articulate sounds. This machine was exhibited at the Royal Institution in 1835, by Professor Wheatstone.

Von Kempelen, the inventor of the Automaton Chess-player, also constructed a speaking automaton, which he made pronounce several sentences, amongst the best of which were, "Romanorum imperator semper Augustus;" "Leopoldus secundus;" "Vous êtes mon ami," "Je vous aime de tout mon cœur." It was some years, however, before he could accomplish more than the simple utterance of the sounds, *o, ou*, and *e*. Year after year the inventor devoted to this machine, but *i*, or *u*, or any of the consonants, refused to obey his summons. At length he added at the open extremity of the vocal tube an apparatus similar in action and construction to the *human mouth with its teeth;* when he succeeded not only in making it pronounce the consonants, but words, and even the sentences quoted above. He had previously imitated the tongue and its actions. The fact is interesting, not only as a rare instance of human ingenuity, but also as exhibiting in a most striking light the beautiful adaptation of parts to their respective functions, and that so perfect are the contrivances of Nature for particular ends, that in order to arrive at anything like an imitation of these functions, we must follow closely the method she employs.

In 1843 there was exhibited before the American Philosophical Society, a speaking machine of various movements, by means of keys, and thus made to enunciate various letters and words; in enunciating the simple sounds, could be seen the movements of the mouth, the parts of which were made of caoutchouc. The inventor, Mr. Reade, however, in a frenzy, destroyed this machine, which had taken him sixteen years to construct.

Three years later, in 1846, there was exhibited

at the Egyptian Hall, in Piccadilly, the *Euphonia* of Professor Faber, of Vienna, the result of twenty-five years' labour. It consisted of a draped bust and wax-faced figure, which articulated language almost as intelligibly as is done by the human organs in individuals who do not speak very distinctly. The sounds were produced by striking on sixteen keys. There was a small pair of bellows, which was worked with the nozzle into the back part of the head, and the mouth-formations were of caoutchouc, and they moved up and down like the nutcracker toy, and the sounds were heard in sentences. Whispering was also managed with a very odd effect, and from the mouth the wind of the bellows was perceptible to feeling. Professor Faber's machine is considered the nearest approach to perfect success, and the several attempts of Cagniard la Tour, Biot, Müller, and Steinb, to produce articulate sounds, or even to imitate the human voice, have not been successful.

Curiosities of Character.

A MAN OF BUSINESS.—According to Sir Richard Baker, the versatility of the celebrated Cecil, Lord Burleigh, as well as his untiring activity, was astonishing. He tells us that besides attending to business in council, he daily wrote twenty or thirty letters on subjects of a domestic character, and many despatches connected with foreign affairs; while there never passed a day during term time in which he did not receive from sixty to a hundred petitions which he commonly read the same night. Nothing seems to have been considered too momentous for him, or too minute. His opinion was solicited at one and the same time on the succession of a queen and the punishment of a schoolboy; the terms of a treaty and a regulation for the lining of a slope-hose; an insurrection in the north and a brawl in the streets of London.

A METHODICAL MAN.—Dr. Chalmers had an eye to numerical arrangement in almost everything he did. His biographer (Dr. Hanna) relates that "it regulated every part of his toilet, down even to the daily stropping of his razor. Beginning with his minimum, which was two strokes, he added one stroke more each day successively, till he got up to a number fixed on as his maximum, on reaching which he reversed the process, diminishing the number by one each day, till the lowest point was touched. His staff was put down to the ground regularly at each fourth footfall; and the number of its descents gave him a pretty accurate measure of the space over which he walked. Habit had rendered the counting of these descents an easy, indeed almost a mechanical operation; so that, though meeting friends and sustaining an animated conversation, it still went on."

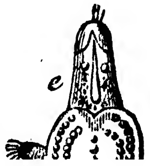
THE PERFECTION OF POLITENESS.—Mr. Lear, in his "Journey of a Landscape Painter in the East," relates an anecdote of the postmaster of Pella, the birthplace of Alexander the Great. The artist was taking a parting cup of coffee with him, and had the misfortune to set his foot on a handsome pipe-bowl. Crash went the bowl, but the Mohammedan sat unmoved. Mr. Lear apologised. "The breaking of such a pipe-bowl," said the postmaster, "would indeed, under ordinary circumstances, be disagreeable; but in a friend every action has its charms."

THE WHEEL ANIMALCULE.

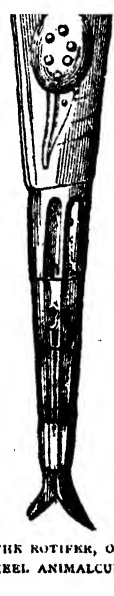
THERE are many kinds of animalcules found amongst the leaves of water-plants and about sea-weeds, which are just visible to the naked eye, and whose movements can be traced by watching the whirling motion of the small grains of mud in their neighbourhood. These small creatures, when examined under a microscope, are very easily seen, and the inside of their bodies is so transparent that the whole process of eating and digesting can be observed. They are furnished with one or more bell-shaped ends, and the rim of the bell is covered with the long movable hairs called ciliæ, and which are found in all animalcules. The bottom of the bell is covered with a funnel which leads to the jaws, and then comes a gullet and a stomach with a gut. The animalcule has a single eye close to the bell-rim, and it has great powers of changing its shape, owing to many muscles and fibres which commence near the jaws and ciliæ, and reach down to the tail. The creature is usually something like a leech in shape, and the tail is cleft like a clothes-peg, the two ends having the power of grasping anything between them. All the body is surrounded by a beautiful transparent coat. When the ciliæ of the bell-rim begin to move, they do so one after the other in regular succession; consequently the appearance of a revolving wheel is produced, and hence the name of the wheel animalcule or "rotifer." It can move its ciliæ as it likes, slowly or very quickly, and the result is a great disturbance amongst all the small particles and tiny animalcules close by. When there are two bell-rims, the ciliæ move at the same pace in both, and the appearance is exactly like that of revolving wheels—really, there is no movement of the rim, but the eye is deceived by the rapid succession of the motion of the hairs. When there are as many as seven wheels the sight is wonderful, especially if a little carmine is added to the water, for then the separate whirlpools of each wheel can be seen.

The rotifers have nerves, and can regulate their movements. They can see, and they evidently can select their food and establish themselves in quiet safe places. If they wish to swim about, they let

go their hold by separating the ends of their tail and spreading out their bell-rims, and they move the ciliæ with great rapidity. The rotifers then rush forward, wheel in front, guiding themselves by twisting their transparent bodies, or by using the tail as a rudder. When they wish to go slower, the rim of the wheel is contracted and the ciliæ do not move so quickly, and when they wish to stop, the movement of the delicate hairs ceases. The wheels are often drawn down quite within the body, and its fine glossy coat, and then a sort of snout projects in their place. By means of this and the tail the rotifer often crawls about on the moss or at the bottom of the pond. When hungry, the rotifer fixes itself by its tail, stretches out its body, pushes forth its wheel, and sets the hairs in vigorous movement. Not only is a whirling movement produced in the surrounding water, but currents are formed which draw small things from the water into the funnel under the wheel. It is quite wonderful to notice the rush down this hole of things which cannot swim against the stream, and most interesting to observe the jaws champing and crushing everything not too big for them. The stomach soon gets full, and the microscope traces the remains of the hard parts of many kinds of smaller animalcules through its transparent coats. When the rotifer attains a certain size, some transparent eggs are noticed inside it; these break out by some means or other, and become attached to the outside of the parent. The tiny rotifer in the egg is always moving round and round, and its growth can be studied from the time when it was a simple mass of jelly to when it becomes a minute likeness of the old one. After awhile it bursts the shell and rushes forth to lead the same kind of life as its predecessors. Some rotifers live inside the vegetable tissue of mosses, and swim in and out; others frequent gutters and small ponds, and they are generally not highly coloured. One kind lives in the skin of fishes, but is only carried about, for it does not eat the fish or live on its juices. A very interesting rotifer lives on the snow, where it is tinted red by a curious microscopic plant. Red snow occurs now and then in the polar regions, and in the Alps, and is produced by the rapid growth of a microscopic plant which produces red granules within its delicate tissues. It has nothing to do with the snow except that it melts a small portion, and lives in consequence of the moisture. The rotifer that lives amongst this plant is not an uncommon creature in the streams of Yorkshire.



The tenacity for life is perhaps one of the most wonderful things about the rotifers. This was discovered in 1702 by the great Leuwenhoeck. He wrote as follows:—"In October scoured the filth or dirt of the gutters when there was no water there, and the dirt was quite dry, to be gathered together, and took a teacupful of the same, and put it into a paper upon my desk, since which time I have often taken a little thereof, and poured upon it boiled water. After the above-mentioned dry substance had lain nearly twenty-one months in the paper, I put into a glass tube the remainder I had by me, and poured water into it. The water was always boiled, because no animalcules can live in it, and therefore none could be introduced through it into the tube. Many round particles subsided to the bottom of the tube, and some hours after I discovered that they were animalcules, and that a few had unfolded their bodies, swimming about the water, whilst others had not unfolded themselves. Now, ought we not to be astonished to find that these small insects can lie twenty-one months dry and yet live, and as soon as ever they are placed in water fall a swimming or fastening the hinder parts of their bodies to the glass, and then produce the wheels, just as if they had never wanted water? Some of the bodies of these animalcules were so strongly dried up that one could see the wrinkles in them, and they were of a reddish colour. A few others were so transparent that if you held them up between your eye and the light, you might move your fingers behind them and see the motion through their bodies."



THE ROTIFER, OR WHEEL ANIMALCULE.

Instances have been given by the most celebrated naturalists of the preservation of dried-up rotifers in dry sand for four years; and Professor Owen witnessed the revival of one after it had been in this position all the time. It is an experiment readily made, for if some rotifers are placed on a slip of glass, and the water is drained off gradually, they begin to roll themselves up within their transparent cover, and when the glass is dry they stick to it and diminish in size, becoming wrinkled. If some water is added in a few days, and the tiny spots are examined, their gradual return to perfect rotifers will very generally be noticed after a few minutes.

THE WONDERS OF BUTTERFLY LIFE.

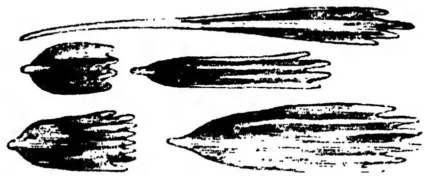
SOME of the old workers in stained glass who made the grand coloured windows for ancient cathedrals and monasteries, were fond of producing figures

THE SWALLOW-TAILED BUTTERFLY (*Papilio Machaon*), WITH CATERPILLARS AND CHRYSALIS.

of a gaudy butterfly, when they wished to represent the idea of the resurrection from the dead. The butterfly, with its expanded wings, gay colours, and lively flight, was to them, as it is to us, a proof that beauty could follow hideousness in the ordinary course of nature, and it was an emblem that the immortal spirit would cast off the gross body of our senses and animal mind. What a difference there is between a green and yellow caterpillar, covered with bunches of hair here and there, and not smelling over nice, that gorges cabbage-leaves hour after hour and day after day, and the delicate white butterfly, with its black spot on its large wings, its long proboscis, which rarely is used, its silky body, pretty long horns, and hesitating flight! The caterpillar becomes a chrysalis, and this the perfect insect. To the eye there is a decided change of form—a metamorphosis; but to the anatomist there are proofs of internal and external changes in the construction of the tissues and organs that are most wonderful. Whence does

the butterfly derive its wings? There is no trace of them in the hairy and thick skin of the caterpillar. If a caterpillar is dissected, the skin is noticed to cover some muscular fibres, by which the insect lengthens or shortens its body and crawls, and inside these is the cavity through which the green blood circulates, and which surrounds the great stomach. There are no traces of wings, and therefore it is not correct to say that the caterpillar contains the imperfect organs of the perfect insect. But when the caterpillar has grown to its full length, and cabbages have become rare, it retires to a quiet nook and begins to diminish in length. It fixes its hind legs tightly to a board or tree, by weaving a little web with its mouth, then it curves its body and fixes a silk thread on one side of it on the wood, and throwing its head backwards, it curves its body to the other side, fixing the thread on the opposite side on the wood. The caterpillar then straightens itself, and, being securely lashed by its feet, and tied tightly by its silken girdle to the wood, it changes its skin, and from under the old one appears the queer-looking thing, without legs, mouth, or hairs, called the chrysalis. This has a brown skin, and on either side of the body is a sort of fold; and within this the process of wing-making is going on all through the winter, although the chrysalis never moves, and does not eat or drink. The pretty body and the delicate head are being formed within the brown skin, and even the stomach is undergoing alteration in form, while the muscles of the caterpillar are being changed into those which can move the wide wings and the delicate legs of the butterfly.

At last, on some fine spring day, the brown skin of the chrysalis splits, and the butterfly comes out with its wings nicely folded. It soon gains energy in the sun, and breathes the fresh air, the wings unfold and become stiff, and the little creature flies off with a careless flight, but in a manner which no mechanism yet invented can enable man to imitate. Examined under a strong magnifying power, the wings are most beautiful. They consist of a fine membrane, quite transparent; it has two layers, and between them are the rib-like markings, which are really tubes formed by myriads of rings of membrane placed side by side. These tubes are the breathing apparatus, and the air passes into them and is carried by other tubes into the body, and amongst the muscles, and even around the stomach. On the layers of membrane are rows of very small dark dots, one row regularly succeeds another until the wings outside and inside are covered. These dots are the spots where tiny scales are fixed, and each scale is a miniature wing; when a butterfly's wing is pinched, these come off, and if examined under a good microscope, markings will be seen on them like smaller scales, and there are also some fine hairs attached to both ends. The colours shown on these scales depend partly upon the influence of very fine lines upon the light, and partly upon the presence of grains of colouring matter in their structure. Nearly every kind of butterfly or moth has its peculiar scales, and it is very interesting to notice how the flat scales gradually become hairs and spines on different parts of the wings. The scales are attached to the


SCALES OF A BUTTERFLY'S WING.

membrane of the wings by one spot only, and probably they hold the air when the butterfly makes a stroke with its wing. The minuteness of some of the scales in very small moths is so extreme, that they cannot be seen with the naked eye, but the most powerful microscopes distinguish other dots and imitation scales on them.

The beautiful proboscis, which is curled up under the head of the butterfly, is very different from the sharp, crushing, cabbage-eating jaws of the caterpillar. It is rarely used; but when some very tempting flowers are near, the insect may unfold it and place its tip in the honey at the bottom of the flower. There is a small bag in the gullet which is connected with the proboscis, and it contracts and expels all the air out of the sucker. Then, when the end touches the honey, the bag dilates, and the sugary liquid rushes up. The butterfly takes but little food, for the caterpillar had laid in such a store, that it furnishes the new clothes of the perfect insect and its food as well. The caterpillar has this use, that it can spin a thread, which in some kinds is a true silk, but the butterfly has nothing of the kind to do. The caterpillar's throat has a small opening in it on either side, just within the mouth. This opening leads to a long tube ending in a bag-shaped gland, which lies on either side of the stomach. The liquid in this bag is the future thread of the silk, and when the caterpillar wishes to use it, either to hang itself from a leaf, or to make the cocoon which surrounds some of the chrysalids, it glues the end of the thread to something steady, and by pulling back its head draws forth a liquid which turns solid immediately. There is not a reel of silk inside the caterpillar, but give it plenty of food, and it will spin a great length of very light but strong stuff from the liquid in its glands. The butterfly lays eggs and glues them to the dry substance nearest the future food of the young, and every species regularly chooses the same kind of tree or shrub, generation after generation.

THE EXPANSIVE POWER OF WATER.

It is a well-known, but not less remarkable, fact that if the tip of an exceedingly small tube be dipped into water, the water will rise spontaneously in the tube throughout its whole length. This may be shown in a variety of ways; for instance, when a piece of sponge, or sugar, or cotton is just allowed to touch water, these substances being all composed of numberless little tubes, draw up the water, and the whole of the piece becomes wet. It is said to *suck up* or *imbibe* the moisture. We see the same wonderful action going on in nature in the rising of the sap through the small tubes or pores of the wood, whereby the leaves and upper portions of the plant derive nourishment from the ground.

This strange action is called "capillary," from the resemblance the minute tubes bear to a hair, the Latin of which is *capillus*. It is, moreover, singular that the absorption of the water takes place with great force. If a dry sponge be enclosed tightly in a vessel, it will expand when wetted with sufficient force to burst it, unless very strong.

Wood, which is a more unyielding material, acts with tremendous force when wetted, and advantage has been taken of this fact in splitting blocks of granite. This process is largely adopted in Dartmoor. After a mass of granite has been rent from the mountain by blasting, it is measured in every direction to see how best to divide it into smaller blocks. These are traced out by straight lines on the surface, and a series of holes are drilled at short intervals along this line. Wedges of dry wood are then tightly driven into the holes and wetted, and the combined action of the swelling wood splits the block in the direction required, and without any destructive violence. The same process is then carried out upon the other faces, and the roughly-shapen block finished with the hammer and chisel.

THE ELIXIR OF LIFE.

How to preserve health, cure disease, and prolong life, are problems which have naturally occupied the anxious attention of mortals, ever since that remote period when the first death startled surviving humanity. Even philosophers have imagined that there must be in nature some element or production which, if found, would cure all bodily ills, and enable man to attain a more than patriarchal age. The old alchemists, in addition to their search after the philosopher's stone, set themselves to work to discover such a production, which they termed *elixir vitæ*, or the elixir of life. Sometimes they believed themselves that they had hit upon it, and were reputed by others to have done so. The great alchemist and chemist of our own country, Roger Bacon—the discoverer of gunpowder and the inventor of the magic lantern—was one of those who firmly believed in the elixir. He held the opinion which had been suggested by alchemists of a much earlier date, that it was to be found in gold reduced to a solution by a strong acid. There was a story current in his time that an old man, while ploughing, turned up in a field in Sicily a golden vessel which contained some yellow water, and, venturing to drink it, found his wrinkles and his decrepitude pass away, so that he again enjoyed youthful vigour. The tale was believed by Bacon, and he had no doubt that this wonderful liquid must have been the solution of gold. He drank, it is said, repeated draughts, to enjoy its beneficial effects; and when he died, at the good old age of eighty, many of his contemporaries believed that it not from natural causes, but from poison administered by some of his brother monks.

After him rose others with equal faith in the elixir. Roger Bacon died at the close of the thirteenth century. Two hundred years after, the Swiss chemist, Paracelsus, was reputed throughout Europe to have made the grand discovery of the elixir. He certainly cured diseases in what appeared to be a marvellous manner, but it is now believed that the means he employed were simply the free use of mercury and opium, which remedies were repudiated by the doctors of his time. He made great pretence of having been initiated into many of the hidden mysteries of alchemy in the East, where he had accompanied the son of the Cham of Tartary on his travels. But his credit as a possessor of the elixir was very much shaken when he died at the comparatively early age of forty-eight.

The pretended possession of an *elixir vitæ* was a fertile source of gain to quacks such as Dr. Dee, who made alchemy a kind of accompaniment to fortune-telling. But while the ignorant and credulous were always ready to believe any impostor who declared he had found it, there were others of a widely different stamp who believed, with Roger Bacon, that the elixir was really accessible to scientific research. Francis Lord Bacon, a greater man in science than his namesake, was one of these, and he left in his works sundry precepts to be observed in the investigation. The great French philosopher Descartes believed he had discovered the elixir, and is said to have confidently expected that he would attain the age of some hundreds of years. Nevertheless, he died when he had reached fifty-five only. His friends, however, as in Roger Bacon's case, so firmly trusted the philosopher's own opinion, that they persisted, on his death, that he must have been poisoned.

Belief in the elixir has long faded away, or, if held occasionally by individual enthusiasts, they find the progress of knowledge and thought in modern times has disposed the world to scout the notion as preposterous.

COMETS.

Any of the readers of the World of Wonders who are old enough to remember the year 1858, will probably never forget the magnificent phenomenon which was witnessed in the heavens that year, when a comet of great brilliancy, size, and splendour, was most favourably seen for several weeks during autumn. Had this wonderful appearance happened a thousand years ago, it would have been rather a source of superstition to the ignorant than of intelligent interest to the learned; but the progress of knowledge, and the diffusion of education, cause us now to seek in these wonders of nature some revelations of her laws, and to endeavour to divest them of the mysteries in which they are shrouded.

These wonderful appearances have frequently happened within historic periods, but not so often as to diminish the admiration and amazement with which each new arrival is greeted. Two of the more remarkable of these are figured in our illustrations; but before proceeding to a particular account of them, it will be well to give a short outline of what astronomers have been able to make out with reference to these curious objects.

THE COMET OF 1811.

A comet consists of a vast mass of gaseous matter surrounding a central portion which appears to be of denser material, and is called the *nucleus*. This vast mass of luminous gas generally assumes the form of a tail; but this is not always nor even generally the case, as a comet sometimes is nearly round, and sometimes it does not even present the nucleus, and in that case it appears like a round ball of luminous gas. Cases have, however, occurred where a comet has been seen with several tails.

Though comets large enough to be conspicuous to the naked eye are only seen at intervals of many years, it is well known to astronomers that hardly a year passes without one or more small comets being brought within reach of our telescopes. These objects are very faint, the majority of them are devoid of tails, but they always attract a great deal of attention from those who have telescopes sufficiently powerful to observe them. It is by the careful examination of some of these small comets that much information has been acquired as to their real nature, and the laws which govern their movements through the vast abyss of space. The earth and the planets are retained in their orbits by the attraction of the sun, and it is the same great power which draws the comets within reach of our eyes and telescopes. The planets move around the sun very nearly in circles; many comets likewise revolve around the sun, but not in circles; their paths are oval or elliptical, and the sun is not at the centre of the ellipse, but near to one end of it, in a point which is known as the focus of the ellipse. These ellipses are generally very long, so that the comet takes a great period of time to travel round in its path. The one which takes the shortest journey spends three years in performing it. There are some comets that, after passing near the sun in their elliptical orbit, retreat to the other end of their ellipse, which is at such a prodigious distance that thousands of years must elapse ere they revisit the neighbourhood of the sun again. One of these was a great comet which appeared in the year 1844. Its orbit was calculated, and it was found that after leaving the sun, it would retreat into space to a distance equal to four thousand times the distance of the earth from the sun, and that ere it returned again, it would have performed a stupendous journey, which would have taken it not less than a hundred thousand years to accomplish.

But there are many comets which astronomers can prove will never again return to the neighbourhood of the sun. They come from the remote depths of space, at a stupendous distance from the sun and all his train of planets; on beginning to feel the effect of his attraction, they move towards

our system, and at length they come sufficiently near to it to be visible through a telescope, and as surely as they do so, so surely are they detected by the keen eyes of some of the numerous astronomers who are always on the watch for these bodies. They come on nearer to the sun, till their pace exceeds that of the earth itself, but they do not plunge headlong into him. Notwithstanding the vast powers of his attraction, they just whirl round the mighty luminary. Exposed to the fearful heat of his beams, the tail is developed to an enormous length. By some unknown law, which Professor Tyndal has recently sought to explain in a very ingenious manner, the tail stands out away from the sun as the comet whirls around it; then, after having passed the sun, the comet retreats again. It gradually becomes fainter, gradually is lost sight of by our telescopes, gradually plunges again into the depths of space, never again to revisit our sun, never again to be beheld by human eye. Such is the history of many of the great comets which at different times have struck terror into the inhabitants of the earth—they have retreated never more to return.

A celebrated comet, which showed itself in the year 1811, is represented on page 340. The appearance of this produced a most extraordinary sensation. It extended over a vast length in the sky, and formed an object of attraction to millions while it lasted. It was particularly remarkable for the enormous length of its tail, which would reach from the earth to the sun, and have some millions of miles to spare. The head of this comet—that is, the round portion from which the tail proceeds—was measured, and found to be a vast globe 112,000 miles in diameter—that is to say, a gigantic ball, amounting to more than a thousand times the bulk of the earth. Contained within the head was a bright luminous nucleus, which appeared to be the densest part of the comet. This portion had a diameter of 400 miles.

THE GREAT COMET OF 1843.

The material of which comets are constructed is undoubtedly gas in a state of the most extreme tenuity. Stars so faint that the slightest trace of mist or fog would utterly obliterate them, are seen with the greatest ease through the densest portion of a comet's tail; so that millions of miles of this gas have not the effect of a small mist a few yards thick. From this and other reasons it is thought that the entire mass of a comet is something incredibly small compared with its gigantic bulk. Sir John Herschel has estimated, taking the fact above mentioned and others into account, that perhaps the very largest comet does not weigh more than a few ounces.

In our second illustration is seen the great comet of 1843, one of the most remarkable that was ever observed. The nucleus of this was so brilliant that it could be seen with the greatest ease in full daylight. In our drawing it is represented as near the moon, but a comet so grand as this one would have lost but little of its splendour by its vicinity to the bright beams of our moon. This comet is remarkable for coming nearer to the sun than any other of these bodies whose paths have been determined with accuracy. It was found to approach the sun to within a distance of 33,000 miles. It is easy to calculate, though not easy to imagine, what must be

the heat in such a position. It would doubtless be many thousand times greater than the temperature of molten iron.

Speculations have often been indulged in as to the possibility of a collision between the earth and a comet. That such a collision, though highly improbable, is yet possible, cannot be denied. In fact, it can hardly be doubted that the earth has ere now been enveloped in the tail of a comet, its inhabitants being quite unconscious of the fact. But if we recollect what is probably the case as to the real weight of a comet, we can easily see that even if a direct collision did occur, it could not produce any destructive effects on the earth.

Antiquarian Curiosities.

INVENTION OF THE SUN-DIAL.—To the Assyrians Herodotus ascribes the invention of the hemispherical sun-dial, which he had seen in use in Egypt. This was, in effect, a device which exhibited both the daily and the annual motion of the sun. A basin was formed of metal, from the middle of which a vertical pin was set up, terminating in a knob, which represented exactly the centre of the hemisphere. It is plain that the shadow cast by this knob on the side of the basin traced out, as it moved from sunrise to sunset, the projection of the sun's actual movement in the heavens day by day. In the treeless plains of Mesopotamia and the Nile delta, the sharp, definite shadows cast by obelisks and other stiff architectural forms, could not fail to attract earlier attention to the sun than would be the case in the broken ground and wooded regions of Europe.

ANTIQUITY OF BEE KEEPING.—The earliest Semitic records, the book of Job, the Vedas, Egyptian sculptures and papyri, as well as the poems of Homer, confirm the early cultivation of bees by man for domestic uses. Sir Gardner Wilkinson, moreover, makes mention of a representation of a hive figured upon a very ancient tomb at Thebes, which is evidence of their domestication there at an early period of history.

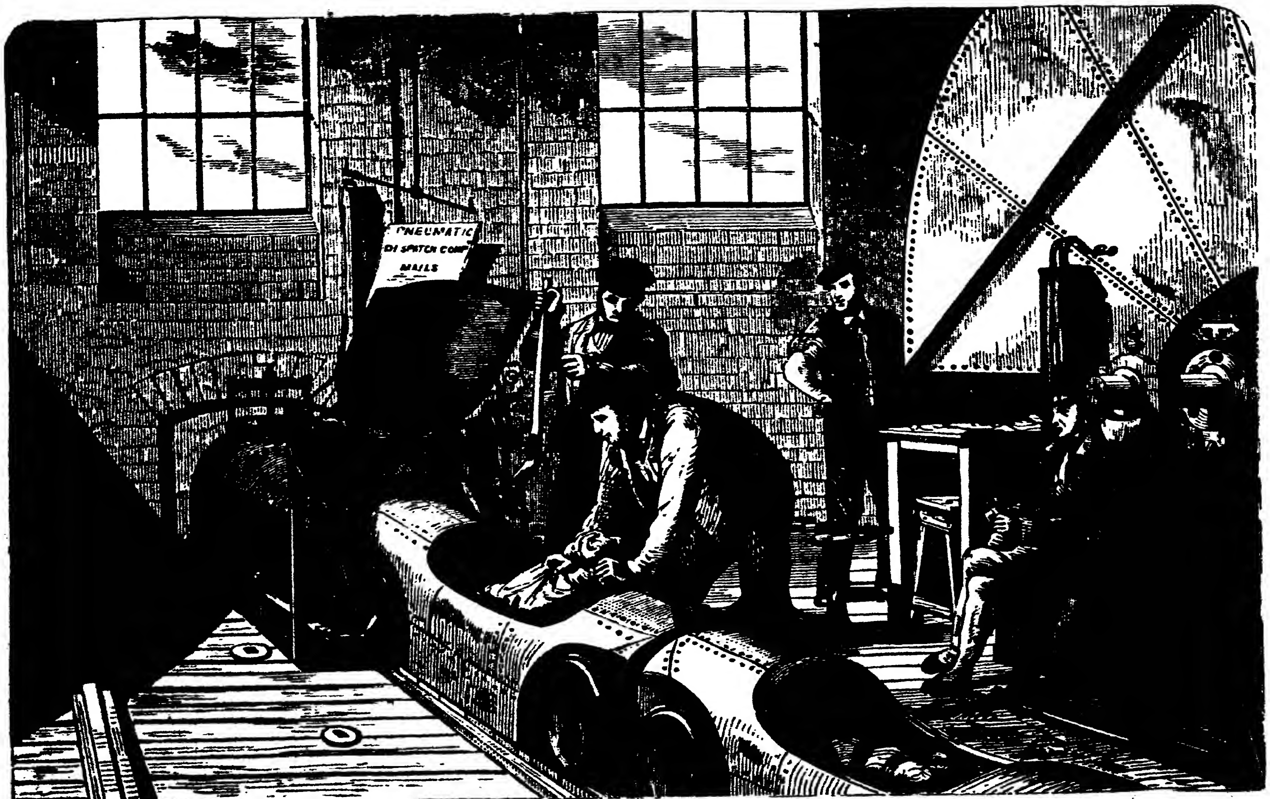
DRAUGHTS AND CHESS IN ANCIENT EGYPT.—Dr. Birch, of the British Museum, in a paper read to the Royal Society of Literature, observes that there is a tradition preserved by Herodotus, that Rhampsinitus, King of Egypt, was led by wolves down into Hades, where he played at petteia (draughts), with Isis, the Greek Demeter, or Proserpine. Rhampsinitus is probably the same person as Rameses III. The game appears as a favourite diversion of the Egyptian aristocracy. The hieroglyphical word for chess is abbo, probably connected with ab, which means ivory; but many of the pieces are of glass and porcelain, and bear the figures of cats, jackals, and other animals. Representations of the game appear in graves of the fifth century, and of the dynasty of Saygazah. Each player has six pieces, each set having spherical heads, but being of different colours. During the Roman period, five pieces only were used. The board was circular, with cylindrical lines, between which flat circular pieces moved to the centre. A game of chess called "sennat" is represented on a sarcophagus as played in the unseen world, with pieces like pawns, coloured black, and with conical heads. Sena, the game of six, formed the amusements of the shades in Hades. Rhampsinitus received a doubled kerchief, or golden neck-circlet (called a napkin by Herodotus), from Isis, with whom he played a stake, possibly for his soul. The Egyptian chess-board had thirty squares alternately black and white.

CURIOUS CUSTOM RELATING TO INHERITANCE.—Salmon, in his "History of Hertfordshire," states his belief that the East Saxon and Mercian kingdoms were separated from each other by the "Ermin Street," in the upper part of this county; and in the lower part, in the parish of Cheshunt, by a bank which anciently reached through Theobald's Park, as far as Nineacres Wood. There is, he says, a custom in the manor of Cheshunt, by which the elder brother inherits above the bank, and the younger below it, in the same fields; which could not have been introduced but from the different laws of a different government.

A WONDERFUL ESCAPE.

THE defence of the Residency at Lucknow, during the Indian mutiny from June to November, 1857, has been justly termed one of the most marvellous that has ever been recorded in history; and among the great deeds of bravery done during the siege—and the whole garrison was a band of heroes—the greatest, by common consent, was that of Thomas Henry Kavanagh, which gained him the Victoria Cross and the honourable cognomen of "Lucknow" Kavanagh.

When the mutiny broke out, Mr. Kavanagh, who was not in the army, was enrolled as a volunteer with the rest of the civilians at Lucknow, and nobly and well did he perform his military duties. The garrison was relieved by General Havelock on the 25th of September, 1857; but it was still sorely pressed for provisions, and doubts were beginning to arise whether it would be possible to hold out much longer, when a native spy arrived on the morning of the 9th of November, with a despatch from Sir Colin Campbell to say that he was approaching with relief. To save loss of time and lives, plans for effecting the entrance to the Residency had been previously drawn up for the guidance of the army of relief; but without explanation from some one knowing the place and approaches, they would



10 PNEUMATIC DESPATCH. (See page 343.)

have been of little use. Then it was that Kavanagh volunteered to pass through the lines of the enemy to take the required information. In the excitement of a charge, or in the heat of a battle, men will often do deeds of daring they would shrink from in cooler moments; and surely it is a higher kind of bravery which induces a man, for the benefit of others, deliberately to face almost certain death, and a death, most likely, of slow torture! Kavanagh's perfect knowledge of Hindustani was in his favour, and the oriental disguise he assumed was such that even his most intimate friends did not recognise him when he appeared before them.

At half-past eight o'clock on the evening of the 9th of November, he started on his perilous mission, accompanied by the native spy who had brought the despatch in the morning. Their perils began immediately on quitting the Residency. They had to strip and swim across the river Goomtee, which bounds the city on one side, and narrowly escaped being seen by a native who had come down to wash in the river. They proceeded along the left bank of the river, meeting several Sepoys, and were stopped at the foot of one bridge by a sentry. The answers given by the spy being satisfactory, they continued their course along the bank till they reached the stone bridge, over which they crossed and entered the principal street of the city. They advanced along the middle of the street, as if courting observation, till they reached the open country; where, being stopped once more, and again allowed to pass, they went on their way for about four or five miles, when they found to their dismay that they had taken the wrong road. They had the greatest difficulty in finding the right one. In going across the country in the darkness, they fell into ditches and were nearly drowned; and they had to avoid with the greatest care the native villages.

At last they were once more in the right path, and at about one o'clock in the morning they fell in with an advanced picket of the mutineers. Kavanagh boldly and successfully answered the challenge of the sentry, and they continued their course for some time till they reached a mango grove, where the native sentinel, hearing footsteps, raised the alarm and called out the guard. The spy lost his presence of mind, and had it not been for Kavanagh's bold bearing and ready answers to the questions put to him, most likely they would have been discovered. They passed on, and presently fell into a swamp, where the water was often as high as their necks. Quite exhausted, and nearly drowned, they managed, after two hours' immersion, to get once more on to dry land. Though the water had washed the paint off Kavanagh's hands, it had not, fortunately, reached his face; and they resumed their journey till they reached a native village, where they gave themselves out as spies, and asked to be directed to the English lines, which were now close at hand. They lost their way once more, and were once more nearly taken, when, at about four o'clock, they reached a grove of trees, and Kavanagh, quite exhausted with cold and fatigue, threw himself down on the ground to sleep. He had hardly done so when they heard a sentinel's challenge in English, "Who goes there?" and found, to their joy, that they had come upon a picket of Sikhs, and were therefore safe. It was not long before Kavanagh was in the presence of the Commander-in-Chief, narrating his adventures. The information he had brought was the means of saving many lives and much treasure; and his wonderful escape was, in the words of Sir Colin Campbell's despatch —the stern old man being ever chary of his praise—"one of the most daring feats ever attempted."

THE ATMOSPHERIC RAILWAY.

THE idea of employing atmospheric pressure to the propulsion of trains, dates as far back as 1824. The Atmospheric Railway must not be confounded with the Pneumatic Despatch; for although in each case air is the motive power, the two systems are essentially different. In the case of the Pneumatic Despatch, the pressure is the result of the great velocity imparted to the air; whereas in the Atmospheric Railway system, it is the pressure of the atmosphere which acts with equal force upon all surfaces on a level with the ocean, exerting a weight of between fourteen and fifteen pounds upon every square inch, although only manifested when the atmosphere is artificially removed from one side of a body by exhaustion. The well-known and often-stated fact that an ordinary sized man's body contains a surface upon which the atmosphere presses with an aggregate force of fourteen tons, is merely repeated here as a proof that the natural pressure of the air is no mean force when exerted upon a large surface, and quite equal to the attainment of great results when properly directed.

The first idea of an Atmospheric Railway was more closely allied to the Pneumatic Despatch than that subsequently developed. This was to cause the carriages to pass through a large cylinder, the front carriage having a disc attached to it which, fitting the cylinder air-tight, acted as a piston, the air being exhausted in front by a pump. This idea lay dormant until 1827, when it was revived, but only for a short time, by Mr. Medhurst, and then finally abandoned.

In 1834 the idea occurred to Mr. Pinkus, that it was by no means necessary that the carriages themselves should pass through the tube, provided a piston could be arranged in connection with the carriage, but outside it, which should be drawn

through the tube, and thus drag the carriage along. The only apparent difficulty was in devising an opening in the tube, which, whilst it allowed the rod connecting the piston with the carriage to pass through it, should not allow air to enter in front of the piston, and so impair the vacuum. Indeed, it was wholly in consequence of this difficulty, and the inefficiency of every plan that was tried in order to fulfil these conditions, that the otherwise beautiful system of atmospheric propulsion fell to the ground, after hundreds of thousands of pounds had been spent upon it.

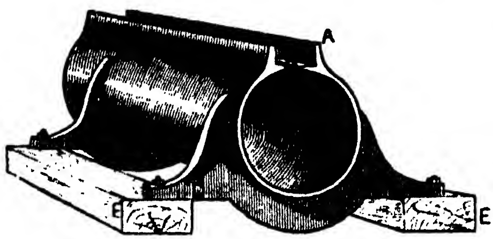


Fig. 1.

The tubes which formed the long cylinder in which the travelling piston moved, were of cast iron, placed midway between the rails. The upper part of the tube was made open, the width of the opening or slot being sufficient to allow the connecting or piston-rod freely to pass along it. Upon either side of the slot, and at a short distance from its edge, was an upright plate of iron, shown at A B in Fig. 1, which represents an end view of the tube. The slot is shown at C. The tube was strengthened by the lugs D, D, D, cast in one piece with it, and by which it was bolted down to the timbers E, E, of the permanent way. The tubes were nine feet long, and carefully joined together, end to end, air-tight. The first kind of valve tried consisted of a long band of strong pliant leather, extending the whole length of the tube between the pumping-engine houses, these being placed at distances of three miles apart. The leather band was laid flat over the slot C between the upright pieces A, B, the under surface being well greased to make it fit air-tight. The piston was placed several feet in advance of the front, or piston-carriage, to which it was connected by the piston-rod, which was a strong iron tube. This rod, after being straight for several feet, was suddenly bent upwards, and passing through the slot in the tube, was fixed to the piston-carriage.

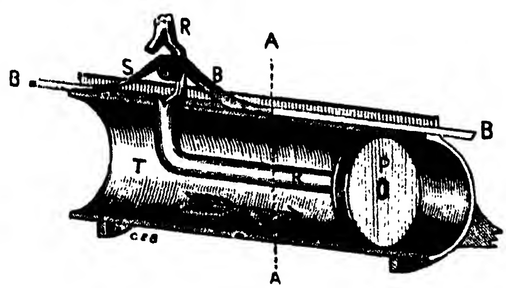


Fig. 2.

Fig. 2 shows the arrangement in longitudinal section. T is the tube, P the piston, R R the hollow connecting or piston-rod, and B B B the leather band raised by the roller S as the rod passed. It will be seen from the drawing that no air could enter the tube in *front* of the piston, because the leather band was not raised from the slot until the piston had advanced in front of the opening shown at the dotted line A A. As soon as the carriage had passed, a second roller attached to it pressed the band down into its place in readiness for the next train.

Another arrangement for a valve consisted also of a long leather band, but it was riveted to short plates of iron placed above it, which were hinged to the side of the upright piece A, Fig. 1. The piston-rod at the point where it passed through the tube was furnished with a kind of ploughshare, by which the hinged leather was raised upon one side as it passed. This plan secured a more certain return of the valve to its bed after the carriage had passed. Other forms of valve were tried, but it is a remarkable fact that after every mechanical difficulty had been overcome, and in spite of the great speed and safety attained by the system, it failed wholly from the impossibility of obtaining a substance which, placed upon the leather to make it lie air-tight upon the slot, should preserve a uniform consistency in all temperatures; that which froze hard in winter became oil in summer, and hence the valve was always more or less leaking.

In the atmospheric system, the power being applied directly, was both more uniform and more effective than where, as in the locomotive, it is transferred through the intervention of a crank.

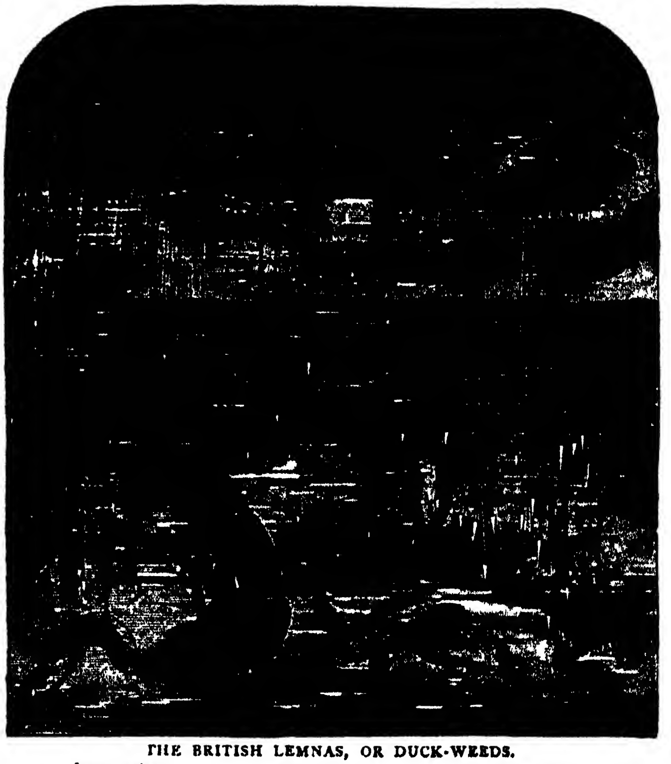
The guard had complete control over the speed of the train, in consequence of the hollowness of the piston-rod. If he wished to slacken speed, he admitted air, by opening a cock, into the tube in front of the piston, and so diminished the vacuum. When the cock was entirely closed, the whole pressure of the air was exerted upon the piston.

There used to be a double set of rails parallel to each other between New Cross and Croydon; upon one set the trains were propelled by a locomotive, and upon the other by atmospheric traction; but the superiority of the latter over the former was completely established, as shown in the constant trials of speed between trains starting at the same time upon the respective sets of rails. As two trains could not possibly be upon the same length of tube at the same time, collisions were impossible.

THE SMALLEST FLOWERING PLANT.

EVERYWHERE the ponds and still waters are covered during summer with small floating green leaves, which are known by the name of duck-weed. Objects so common seldom receive any attention, except from the special student of botany. Yet a world of wonders may be seen by any one who will, with a little care, examine a handful of these weeds, transferred from their native pond into a transparent glass jar, and study the endless variety of minute animals which they support.

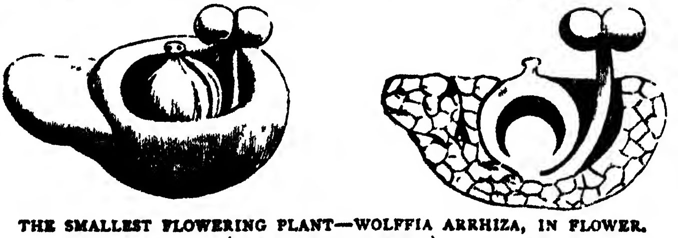
In many pools near London the four different kinds of duck-weed which are indigenous to Britain may be found growing together. All of them are represented in our plate. The most common form is also the smallest; it is a little roundish disc of bright glistening green, generally with two smaller discs, one growing from each side towards the one end of the plant. The apparently varnished upper surface of the leaf is always exposed to the air. It at once throws off any water that may fall upon it. A single long and slender root is sent down into the water. The delicate growing end of this is protected by a cap, something like a small cap of liberty, which is pushed before the growing point. Two of the remaining three agree very closely with this small form, except that one has a large number of roots, and the other has a very thick leaf.



THE BRITISH LEMNAS, OR DUCK-WEEDS.
Lemna minor. Lemna trisula. Lemna polyrrhiza.
Lemna gibba. Wolffia arrhiza.

The fourth has a somewhat different appearance, being oval, with a sharp point at one end, and a little stalk at the other. It also wants the glistening appearance on the upper surface, as it does not grow floating on the water, but just a little under it. These little plants are occasionally, but very rarely, met with in flower. The flowers are inconspicuous, and are produced in little slits on the edges of the leaves.

Popularly, a flower is the opened petals of the plant; and the more numerous the petals, though produced at the expense of the other parts of the flower, the more perfect it is to the florist and the public. On the other hand, the botanist places no importance on the petals; they are to him only the envelopes of the true flower, which is composed of stamens and pistils. Indeed, a very large proportion of the flowers with which he is acquainted are entirely destitute of petals, and composed only of the essential parts just named. Amongst these are the flowers of the duck-weeds.



THE SMALLEST FLOWERING PLANT—WOLFFIA ARRHIZA, IN FLOWER.
Seen from above. (GREATLY MAGNIFIED.) Section.

Three years ago a fifth duck-weed was found in a pond near London, which is specially remarkable for its very minute size. It is a small speck of bright green, somewhat oval in shape, with a flat upper surface, and a swollen fleshy under surface. These plants vary in size—it would require fifty of the smallest placed end to end by their longest diameter to make an inch. Yet in this minute speck a flower is borne, which in due time produces a

perfect seed, enclosed in its proper seed vessel. The flower grows in a pit dug out of the upper surface. It is composed of a single stamen and pistil. The whole plant is entirely made up of small cells, and in this respect it differs from all other flowering plants, which invariably have some vascular tissue entering into their composition.

WHITE ELEPHANTS.

AMONG the animals which in various countries have been the objects of superstitious veneration, few have ever received the attention accorded in the kingdoms of Siam and Ava to a white elephant. Such an animal, when he makes his appearance in the forest, is regarded as sacred; no effort is spared to capture him, and when caught he is housed in regal state, a long train of attendants being allotted to his service. "King of the White Elephants" is considered one of the proudest titles of which the monarchs of these countries can boast; and fierce wars have been waged for the possession of one or more of the beasts. They are looked upon as the symbol of all kingly authority, and to be without one would be taken as an indication of the displeasure of heaven, and a certain omen of disaster.

In Ava especially the white elephant is held in the highest honour. He bears the title of "lord," and is ranked next to the king and before the queen in dignity. His house is sumptuously decorated, and he has a minister of high rank to superintend his household. When there are two or more of these animals in the possession of the king at the same time, all are treated with similar care.

"Their food," says one traveller, "is given them in vessels of silver-gilt. Every day when they go to the river to wash, each goes under a canopy of cloth of gold, or silk, carried by six or eight men; and eight or ten men go before each, playing on drums and shawms, and other instruments. When each has washed, and is come out of the river, he has a gentleman to wash his feet in a silver basin, which office is appointed by the king. There is no account made of the black elephants, be they never so great; and some of them are wonderfully large and handsome, some being nine cubits high."

"While we were at Ava," says another, "a report was brought that a white elephant had been seen; but it was stated at the same time that its capture and transport on a sledge over the cultivated country would be accompanied by the destruction of ten thousand baskets of rice. His majesty is said to have exclaimed, 'What signifies the destruction of ten thousand baskets of rice in comparison with the possession of a white elephant?' and the order was given for the hunt."

For the maintenance of these elephants, one of the finest provinces in the kingdom was allotted by a recent sovereign of Burmah. As, professedly, a mark of high esteem, the monarch has occasionally entrusted the keeping of a white elephant to one of his nobility; but the expense involved in the charge has been, now and then, so great as to ruin the unlucky recipient of this doubtful honour. Hence, "to have a white elephant to keep" has become a common saying when a person has an expensive and unprofitable dignity or undertaking upon his shoulders.

White elephants have been mentioned by very ancient writers. The colour is not, strictly speaking, white, but varies from a cream colour to a tawny yellow or dull grey. The beasts are, in fact, known as white chiefly by contrast with the ordinary colour of their species. They are very rarely found in any part of the East, and it is thought by naturalists that the peculiar colour of a "white elephant" arises from disease; that is, a kind of elephant leprosy. Nevertheless, the beasts, in their dignified captivity, frequently show no symptoms of ill health, but live for a very long period.

Sir James Emerson Tennent remarks that amongst the Singhalese a singular preference is evinced for elephants that exhibit flesh-coloured blotches about the head and extremities, which "appear to be the result of some eruptive affection, the irritation of which has induced the animal to rub itself against the rough bark of trees, and thus to abrade the outer cuticle." He considers the admiration of the natives for beasts thus blemished to have its origin in the general regard of Asiatics for a white elephant.

Wonders of Science.

MAGNESIUM LIGHT.—The light from magnesium is $\frac{1}{524}$th that of the sun, and its chemical intensity $\frac{1}{36}$th part. A magnesium wire $\frac{1}{100}$th of an inch in diameter, emits a light equal to seventy-four stearine candles of five to a pound. It burns at the rate of three feet a minute. Two ounces of the wire of this size will measure 1,800 feet in length, and will take ten hours to be consumed. The relative *cost* of light of equal illuminating power from magnesium, stearine candles, and gas, is as follows:—Magnesium 23, stearine 11, gas 1.

PLYMOUTH BREAKWATER cost one and a half millions sterling, occupied twenty-nine years in completion, is 5,100 feet long, and contains 3,369,261 tons of stone, and has an interstice space between the blocks averaging thirty-seven per cent. of the whole mass.

SPEED OF SOUND.—In ordinary conditions of the atmosphere, sound has been found to travel at the rate of 1,118 feet per second at the temperature of sixty-one degrees; but it travels much faster in

a more rarefied atmosphere, and upon high mountains this is very evident. The measurement of the height of a rocket at the moment of explosion cannot, in consequence, be made according to the ordinary rule.

Reflection of Sound.—The reflection of sound from a row of palings standing obliquely to the observer, comes from each paling at a greater interval of time as the distance increases; but as the distance of each from each is very small, the effect of the rapidly-repeated reflection or echo is to produce a musical note of a high pitch. The sharp crack of a whip produces the effect very distinctly.

Nitro-glycerine is produced by mixing strong nitric acid and sulphuric acid with glycerine. It is poisonous, and the fourth of a grain would kill a dog. Its explosive force is ten times that of an equal weight of gunpowder. With less than an ounce of it a wrought-iron block, weighing about three hundredweight, has been rent into fragments.

BREATHING FIRE.

The deception of breathing out flames, which excites the astonishment of the ignorant, is very ancient. When the slaves in Sicily, about a century and a half before our era, made a formidable insurrection, and avenged themselves in a cruel manner for the severities which they had suffered, there was amongst them a Syrian named Eunus, a man of great craft and courage, who, having passed through many scenes of life, had become acquainted with a variety of arts. He pretended to have immediate communication with the gods, and was the oracle and leader of his fellow-slaves. When heated by enthusiasm and desirous of inspiring his followers with courage, he breathed flames or sparks among them from his mouth while he was addressing them. We are told by historians that for this purpose he pierced a nut-shell at both ends, and, having filled it with some burning substance, put it into his mouth and breathed through it. This deception at present is performed much better. The juggler rolls together some flax or hemp, so as to form a ball about the size of a walnut, sets it on fire, and suffers it to burn until it is nearly consumed; he then rolls round it, while burning, some more flax, and by these means the fire may be retained in it for a long time. When he wishes to exhibit, he slips the ball unperceived into his mouth, and breathes through it, which again revives the fire, so that a number of weak sparks proceed from it; and the performer [illegible] no hurt, provided he inspire the air not through the mouth, but the nostrils. By this art the Rabbi Bar-cocheba, in the reign of the Emperor Hadrian, made the credulous Jews believe that he was the hoped-for Messiah; and two centuries after, the Emperor Constantius was thrown into great terror, when Valentinian, who was afterwards emperor, informed him that he had seen one of the body-guards breathing out fire and flames in the evening.—*Beckmann's "History of Inventions."*

WONDERFUL RIVERS.

Water always finds a level, and in doing so exercises some force on the surface over which it passes. A shower of rain falling on high ground produces many little gutter-like streams, because the water, in obeying the law of gravity, seeks the easiest path downwards, and it causes the removal of sand, small stones, and mud, from the surface of the soil down the stream, because the weight and pressure of the running water call force into operation. After the fall of rain, much goes up again in the form of mist or vapour, and some sinks into the earth, but the greater part works its way by several small channels into tiny brooks, and these, swollen by others, enter torrents or streams, whose junction produces a river. The longer the river, the greater must be the quantity of water it has obtained from the surface of the land around it, and the larger must be the amount of sand, mud, and gravel its streams produce and move.

In almost all cases rivers are found to arise from high land, and usually there are hilly districts not far from the sides of the main streams. The high ground and the hills are called the watershed of the river, and the space between them and the river is termed the river-basin. All the running water from the watershed falls at last into the river, after passing along the basin. Every pint of water in its course to the river carries along so much mud, and displaces as much more, and as the sea finally receives the whole, it stands to reason that the streams are constantly removing the dry land to the bottom of the ocean. When there has been much rain, the rivers overflow their banks, and as at those times the rush of the water is great, so large quantities of mud, sand, and gravel are carried along by it. When the floods begin to diminish, the extra quantity of solid matter they have brought down sinks, and is finally left on the land on either side of the river. Gravel consists of stones from the hard rocks over which the river passes, which have been rolled and rounded by the action of the water; sand is the product of this rolling and wearing, and mud is sand mixed with a large quantity of soil, upon which grass or plants have grown, and which has been washed into the river.

The longer the river the greater is the quantity of mud thrown out on either side of its banks during floods, and, therefore, the greater is the compensation for the wear and tear that goes on in the

high lands of the watershed. Very large and long rivers have thrown out so much mud, both sideways and into the sea, that after awhile their course is lengthened seawards, and they pass along over their own sediment. Such collections of sediment are called deltas, and they are of enormous extent in such rivers as the Mississippi, the Nile, the Ganges, and the Amazon. The depth of the deltas is regulated by the original depth of the sea at the river's mouth, the number of years that the mud has been collecting, and the quantity of water continually rushing by.

The Mississippi, in North America, rises more than 3,000 miles from the spot where it falls into the Gulf of Mexico, and its length, including its windings, is 4,424 miles. It can be navigated for 4,396 miles, and its basin occupies the enormous space of 1,345,974 square miles. That is to say, the running waters of a country as large as Europe, without Russia, Norway, and Sweden, fall into it. The size of the delta is 12,300 square miles, and the thickness is 528 feet or the tenth part of a mile. In some places the depth of this mud is more than 630 feet, for in boring for water at New Orleans this depth was attained without coming to anything but old river deposit; even at the depth of 153 feet, a bog of cedar trees and shrubs was bored through. Every 1,245 grains weight of water that passes New Orleans contains one grain weight of mud, and the relation of the weight of water to its bulk being easily known, it is possible to estimate (if the yearly amount of water passing into the sea is found) how much solid matter is annually carried down by the Mississippi into the sea, and by these means it has been calculated that every year 3,702,758,400 cubic feet of mud, sand, and gravel are worn from the surface of the basin of this river, and are cast into the sea at its mouth.

The Ganges is shorter than the Mississippi, and the immense chain of mountains, the Himalayas, among which it takes its source, rise to a much greater altitude than those which form the watershed of the great American river. It has a large delta, composed of the mud brought from off the surface and washed down by its streams. The delta mud is probably nearly as deep as that of the Mississippi. At Ghazepoor, 500 miles from the sea, the Ganges, when flooded during the four months of the wet season, has a stream that carries down every second 500,000 cubic feet of water, and during the eight fine months this is reduced to 55,000 cubic feet a second. The solid matter carried down with the water amounts to 577 cubic feet a second, and in 122 days of rain the discharge of sediment was no less than 6,082,041,600 cubic feet. Including the smaller quantity passed down in the fine weather, the grand total of the wear and tear of the streams of the Ganges per annum is 6,368,077,440 cubic feet. This calculation was made, it must be remembered, at a distance of 500 miles from the sea. A cubic foot of earth is a piece shaped like the playing dice, measuring 12 inches in height, breadth, and length. This quantity of mud would raise a surface of 228½ square miles—or a square space each side of which should measure 15 miles—a height of one foot. Were the mud dried it would weigh piece for piece about half the weight of granite, and thus the annual discharge would equal 3,184,038,720 cubic feet of granite. Twelve and a half cubic feet of granite weigh a ton, and it is calculated that the Great Pyramid of Egypt would weigh about 6,000,000 tons if it were made of granite. So that the weight of 60 pyramids made of granite is carried down every year by the Ganges. Lyell calculates that if a fleet of more than 80 Indiamen, each freighted with about 1,400 tons weight of mud, were to sail down the river every hour of the day and night for four months, they would only transport from the higher country to the sea, a mass of solid matter equal to that borne down by the Ganges in the flood season.

Wonders of the Human Body.

CHANGES IN THE HUMAN FRAME.—The body (says Lord Brougham) is constantly undergoing change in all its parts; probably no person at the age of twenty has one single particle in any part of his body which he had at ten, and still less does any portion of the body he was born with, continue to exist in or with him. All that he before had has entered into new combinations, forming parts of other men, or of animals, or of vegetable, or of mineral substances, exactly as the body he now has will be resolved into new combinations after his death.

ELECTRICITY IN THE HUMAN BODY.—Baron Humboldt observes that in all parts of organic bodies dissimilar substances are in contact with each other, and thus, wherever there is organisation and life there is also electric tension. Emil du Bois (he continues) has succeeded in manifesting the presence of the electric muscular current in living and uninjured animal bodies. He shows that the human body, through the medium of a copper wire, can cause a magnetic needle at a distance to be deflected at pleasure, first in one and then in the opposite direction.

DEVELOPMENT OF THE HUMAN BRAIN.—Hugh Miller, in his "Testimony of the Rocks," remarks that the human brain is built up by a wonderful process, during which it assumes in succession the form of the brain of a fish, of a reptile, of a bird, of a mammiferous quadruped, and, finally, it takes upon it its unique character as a human brain. Hence the remark made by another scientific writer, that "man is the sum total of all the animals."

THE DEAD SEA.

THE Dead Sea is one of the most remarkable bodies of water in the world. It is situated in Palestine. In the Scriptures it is known as the "Salt Sea" and the "Sea of the Plain." Among classical writers it is called "Lacus Asphaltites." Its most common name in modern times, though not of modern origin, is the "Dead Sea."

This celebrated sea is forty-two miles in length and ten miles at its greatest breadth. It is enclosed on the east and west by dark, rugged ranges of mountains, on the west rising 1,500 feet above the shore, and on the east 2,000 or 2,500 feet. Its northern shore is a flat of mud with sandy plains beyond, strewn in every direction with blackened trunks and branches of shattered trees. Its southern shore is a low sandy beach, entirely unproductive. This extremity of the sea is pictured in our engraving, which will convey to the reader a striking idea of the desolate appearance of the place. Its waters are sullen, generally without a ripple, having the appearance of fused metal. It is said to be formed of two submerged plains, on which stood Sodom and Gomorrah, the smaller of the two being an average of thirteen feet below the surface, the larger 1,300 feet. Usually inland seas are above the level of the ocean, but the Dead Sea is 1,312 feet below the Mediterranean, and nearly the same below the Red Sea.

THE DEAD SEA.

The earliest appellation of this body of water was the "Salt Sea," a name which is as descriptive of its properties as its more modern one, for its waters are without parallel in respect to their saline properties. The solid constituents of ordinary sea water are said by Lieutenant Maury to amount to about three and a half per cent. of its weight. According to Marcet's analysis the solid constituents of the water of the Dead Sea amount to twenty-four and a half per cent., and according to Klaprath, to not less than forty-two and a half per cent. So that, whilst in 100 lbs. of ordinary sea water there would be only three and a half pounds of various salts, in this water there would be, according to the lowest estimate of these eminent chemists, twenty-four and a half pounds. So perfect is the solution in which this ponderable matter is held, that the water examined in a glass is perfectly transparent.

To this striking difference this sea owes its unusual buoyancy. "I could have lain there and read with perfect ease," says Mr. Stephens, a late

American traveller: "in fact, I could have slept." "It requires an effort," says Mr. Paxton, "to keep the feet and legs under so as to use them with advantage in swimming." "I could sit, stand, lie, or swim in the water without any difficulty," says Professor Robinson. Josephus, in his "Jewish Wars," says that Vespasian ordered some men to be bound and thrown into it, and they floated on its surface.

The waters are of extraordinary weight. Between the weight of a pail of ordinary fresh water and a pail of the water of the Dead Sea there is a difference of nearly ten pounds. Dr. Salisbury, of the American Scientific Association, states that whilst a cubic foot of distilled water weighs 61·32lbs., a cubic foot of the water of this sea weighs 71·175lbs. This uncommon density accounts for its dull, unruffled appearance. In calm weather its surface is without a ripple. Ordinary breezes scarcely agitate it, and on the ceasing of a storm it speedily returns to its natural stillness. Captain Lynch, who navigated this sea for the American government, experienced a squall while there. The breaking of the waves against his iron boat he describes as like sledge-hammering. In twenty minutes after the wind had abated they were moving over a perfectly level surface.

It has been supposed that this sea gives forth deadly exhalations. The tribes dwelling in the region of its banks have, since Pliny's days, abandoned it at certain seasons of the year, because of its imagined pestilential character. To two out of three of those gentlemen who have attempted at various times a navigation survey, it has proved fatal, though this may have arisen from intense heat rather than from its exhalations. It has been said that no fish inhabits its waters, but some travellers have gone so far in contradiction of this idea as to say there is a species of fish peculiar to them. Most, however, speak only of dead fish carried into the sea by the Jordan. Maundrell mentions having observed living shell-fish, Dr. Wilson only dead ones on its shores. Captain Lynch says that sometimes at night "the surface of the sea was one wide sheet of phosphorescent foam," and from this it has been inferred that the waters must be tenanted by medusæ and other minute animals. The following fact, however, seems to refute this conclusion. "Since our return," says Lynch himself, "some of the water of the Dead Sea has been subjected to a powerful microscope, and no animalcula or vestige of animal matter could be detected." Speaking generally, the shores of the sea are absolutely barren. The commander of the United States expedition says that some parts are the very type of desolation. From its northern extremity a sandy plain extends along the course of the Jordan, and on the hills which encircle it on the other sides the only thing in the shape of vegetation is a number of tufts of small shrubs from which a kind of balsam is extracted. The idea of the ancients that birds in their flight across the sea were killed by its pestilential air, has long since been placed among fables; and modern travellers speak of birds flying across it with impunity. Stephens even watched a "flock of gulls" launch themselves on its bosom.

The pebbles on the shores are covered with a shiny crust of fossil salt, and after flood seasons, when the water has dried out of the pools left by the falling of the lake, the shore abounds in salt, said to be as fine and well-bleached as that made in our salt works; frequently the sea casts up on its shores pieces of petrified wood in a calcined state. The remarkable saltness of the water is derived from a low, long range of mountains, running along the south-western shore, and consisting of beds of rock salt, varying from 100 to 150 feet in thickness, and nine miles in length. From this range numerous rills are constantly emptying into the sea. Here is the famous pillar coated with asphaltum, shown by the Arabs to travellers as Lot's wife. It rises from an oval pedestal. The pedestal is forty or fifty feet above the water, and the pillar forty feet high.

There is another interesting feature of this sea. The waters of the Jordan, the Arnon, and other tributaries are continually flowing into it, but it has no outlet. Its level being so far below the adjacent seas a subterranean theory is precluded. Yet the sea preserves a sameness of level. This is accomplished by abundant evaporation. Travellers have described this as taking place "in broad transparent columns of vapour, not unlike waterspouts in appearance, but much larger." As evaporation from sea water contains only very minute traces of salt, the Dead Sea must be increasing its proportion of saline substance every year. It becomes specifically heavier every time a cloud of vapour ascends from its surface, and its becoming a bed of fossil salt appears, therefore, to be simply a question of time.

Another ingredient in this noted sea is its bitumen, which is found floating about in blocks, some of them being of huge size, and found in abundance after an earthquake. These blocks are stranded by the winds and collected by the Arabs. The bitumen is said by the Arabs to exude from the surrounding rocks, but it is probable there are bituminous springs in the bed of the sea. On the shores are found lumps of sulphur as large as walnuts. Many of its pebbles ignite when applied to the flame of a candle. On the west coast is a thermal spring, and on the east coast a hot sulphur spring. In the centre of the lake there is a constant rising of gaseous bubbles. These and other facts indicate a somewhat close proximity of slumbering volcanic fire.

WONDERFUL IMPOSTORS.

AMONG the curiosities of history there are to be noticed, every here and there, some singular cases of the impersonation by impostors of men about whose death there has chanced to be some uncertainty, and to whom they have borne a striking resemblance in face and figure. One of the earliest, if not the earliest case on record, is that of Smerdis the Pretender, in the time of Cambyses, King of Persia. The story is told by Herodotus, and runs as follows:—When the king was in Egypt he ordered, through jealousy, his brother Smerdis to be put to death. But soon a pretender arose to push him from his stool in the shape of Tanyoxarkes, the brother of a Mede, to whom Cambyses had deputed the administration of the kingdom in his absence. He so deceived the people by his great likeness to Smerdis, that, tired of the great atrocities of Cambyses, they willingly gave him their support; and when the king died shortly after, from an accidental wound, he ascended the throne without opposition. He reigned for eight months, when a conspiracy of seven noble Persian families was formed against him, and he was murdered in his palace.

According to Herodotus, the way in which the fraud was discovered was this:—The pretended Smerdis, in punishment for some misdeed, had had his ears cut off. One of his wives, Phædymê by name, undertook to feel his head while asleep; and the absence of the ears confirmed the conspirators in their opinion that a fraud had been practised upon them.

The most celebrated cases of impersonation in English history, are those of Lambert Simnel and Perkin Warbeck, in the reign of Henry VII.

Lambert Simnel was the son of a baker at Oxford, and had for tutor a "subtile priest" called Richard Simon. The reported escape of the Earl of Warwick, son of the Duke of Clarence, from the Tower, induced the priest, in the hope of advancement for himself, to instruct his pupil to impersonate the earl, who was next male heir of the house of York to the crown. Simnel went to Ireland, and was crowned at Dublin as Edward VI. The imposture, however, was soon discovered, as the real earl was still in the Tower. Simnel having landed with an army at Fouldrey, in Lancashire, was defeated by the king with great loss at Stoke. He was taken prisoner, but his life was spared, and he was made a scullion in the king's kitchen, and was afterwards advanced to the rank of falconer. As Lord Bacon says, by a curious reverse of fortune, "he turned a broach that had worn a crown."

The real name of Perkin Warbeck was Osbeck. He was the son of a converted Jew of Tournay. His good looks and winning manners gained him an introduction to Margaret of Burgundy, sister of Edward IV., and a confirmed hater of the house of Lancaster. Struck with his gallant bearing and great resemblance to her brother, she resolved to bring him forward as Richard, Duke of York, one of the princes murdered in the Tower. She instructed him well in the part he was to play, gave him an equipage suitable to his pretended birth, and on all occasions addressed him as the White Rose of England. Being a youth of quick parts he answered all her expectations, and so well did he tell his story to James IV. of Scotland, that the king, as a proof of his belief, gave him in marriage the Lady Catherine Gordon, daughter of the Earl of Huntley. After various adventures he landed at Bodmin, in Cornwall; but on the approach of the king he secretly left the army he had collected, and withdrew to Beaulieu, a sanctuary in the New Forest. By stratagem he was taken prisoner and confined for some time in prison; but, being concerned in a conspiracy with the Earl of Warwick to escape from the Tower, he was brought to trial and hanged at Tyburn.

A more successful impostor was Demetrius of Russia, called the False. The grand duke, or czar, John Basilowitz II., died in 1584, leaving two sons. Through the incapacity of Theodore, the elder, Boris, his brother-in-law, gradually seized the whole power in the state. To further his own ends he murdered Demetrius, the younger brother of Theodore, and when the czar died, in 1598, he forcibly took possession of the throne. He governed for some time with great rigour, when a monk named Otrefief, closely resembling the murdered Demetrius, gave out that he was the prince, and that he had escaped the snares of the usurper by the substitution of another youth. The people believed him, and, assisted by the King of Poland, he defeated Boris, who destroyed himself. The son of Boris became czar, but was soon driven from the throne by the impostor, who, in 1605, became czar by the general consent of the people. But his preference for Poland and contempt for the Russian religion and manners soon disgusted his subjects, and he lost his life in 1606 at a tumult in Moscow.

A curious case of successful impersonation was that of the sham Prince of Modena, in 1748. During the war waged at that time with France, a young man of prepossessing looks and manners landed at Martinique with the crew of a French vessel that had been overtaken by an English cruiser. As a stranger in distress, he was hospitably received by the inhabitants of the island; but to all questions put to him as to his origin and whence he came, he returned replies which, by their vagueness, excited still more the curiosity of the questioners. A letter from him and signed "Est" was put into the hands of the commandant of the place, at whose house he was staying. The commandant communicated the discovery to the Marquis d'Eragny, a French noble-

man resident on the island. After deliberation they concluded that the stranger must be Renaud d'Est, hereditary Prince of Modena. Two friends of the marquis knew the prince well by sight. They repaired to the commandant's, and immediately declared that the stranger was the prince. The governor of the Windward Islands, much against his will, also confirmed the impression. The government and revenues of the island were immediately given up to him, and he lived there in regal splendour for eight months. He then sailed for Europe, and was received at Seville with all the honours of royalty. It was soon, however, discovered that the man was an impostor; he was arrested, found guilty of fraud and treasonable practices, and sentenced to hard labour for life. So much, however, did the inhabitants of Seville believe in him, that it was considered necessary that the real prince should show himself to make the imposture beyond all doubt. In the eyes of many, the counterfeit had considerably the advantage of the original in dignity and pleasing manners.

WONDERS OF INSECT LIFE.

SOME years ago a shower of aphides (the and black lice which live on rose and other bushes) emigrated with the aid of an east wind from the hop-gardens of Kent and Sussex, and blackened the shrubs and vegetables where they alighted at Selborne, spreading at the same time in great clouds all along the vale from Farnham to Alton.

Almost every plant has its peculiar kind of aphis, or plant-louse, and as the insects suck the sap, they are more or less destructive. Every few years some succulent vegetable crop is destroyed by them, and Nature has endowed them with a power of increasing their numbers, which is very wonderful. In one year there may be twenty generations, and each of them produces others. A French naturalist proved that one aphis, in five generations, could have descendants to the number of 5,904,900,000. Fortunately, they have many enemies; the lady-bird tribe eat them, the small garden-birds devour them, and the rain destroys millions.

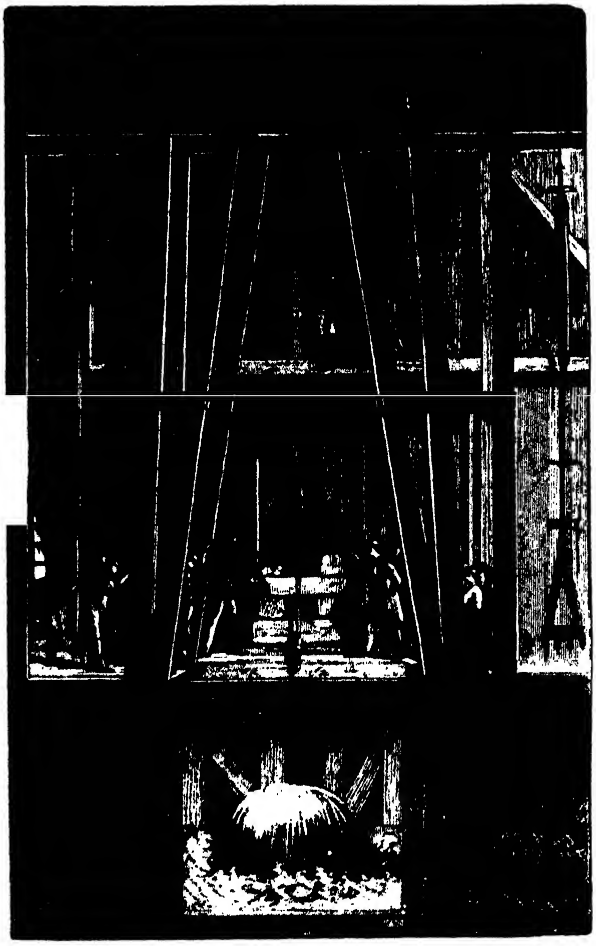
The ants, as we have shown in a previous article, use some kinds of aphides as their cows. On examining a fine plump aphis on a rose-bud, the head of the insect will be seen stuck fast to the delicate bark, by means of a tube which projects right into the rose. The sap and the juices of the plant are sucked up this tube, and pass into and distend the body. On the upper part of the back, and rather near the tail end of the body, two short bristles may be seen; these are really hollow tubes, out of which flows the superabundance of the sap after digestion. Occasionally, drops of colourless fluid are seen coming out of these tubes, but the ants, knowing that touching their ends produces a flow of the digested sap, irritate them with their feelers, and suck up what comes. The aphides are, therefore, distillers from the plant of nourishing drink for the ants.

Livingstone met with a wonderful distilling insect in Africa on fig trees. Seven or eight of the insects cluster round a spot on one of the smaller branches, and these keep up a constant distillation of a clear fluid like water, which, dropping to the ground, forms a little puddle. If a vessel is placed under them in the evening, it contains three or four pints of the fluid in the morning. To the question, whence is this fluid derived? the natives reply, that the insects suck it out of the tree, and naturalists give the same answer. But Livingstone never could find any wound in the bark, or any proof whatever that the insects pierced it. Our common frog-hopper, which before it gets its wings is called "cuckoo-spit," and lives on many plants in a frothy, spittle-like fluid, is like the African insect, but is much smaller. Livingstone considers that they derive much of their fluid by absorbing it from the air. He found some of the insects on a castor-oil plant, and he cut away about twenty inches of the bark between the insects and the tree, and destroyed all the vegetable tissue which carried the sap from the tree to the place where the insects were distilling. The distillation was then going on at the rate of one drop in every 67 seconds, or about $5\frac{1}{4}$ table-spoonfuls every 24 hours. Next morning, although the supplies of sap were stopped, supposing them to come up from the ground, the fluid was increased to one drop every 5 seconds, or one pint in every 24 hours. He then cut the branch so much that it broke, but they still went on at the rate of a drop every 5 seconds, while another colony of the insects on a branch on the same tree gave a drop every 17 seconds. As the insects go on for a long time and flourish on the castor-oil plant, it is clear that they do not suffer from the medicinal virtues of the oil. There is an insect which chooses the rind of the red pepper-plant for its home, and it feeds upon what is hardly eatable by us on account of its hot flavour; and another insect sucks one of the most poisonous plants of Africa with comfort and delight. When the great African explorer was travelling with his children, they were often hungry, and the natives gave them a large kind of caterpillar, of which they all became very fond. All the insects now mentioned seek their nourishment from the sap, which is the blood of plants, and they weaken and often destroy the shrub or tree they feed upon. Thus Nature, while she gives the aphis and the caterpillar as food to animals or to other insects, uses them to destroy the too great abundance of plant-life on the globe.

WONDERFUL WELLS AND HOT SPRINGS.

AFTER rain has fallen it disappears in three ways: some runs off the ground into small streams, brooks, and rivers; some evaporates and mixes with the air in the form of vapour, and the rest sinks into the soil. It is this last method by which rain is got rid of that is of the greatest importance to men, for it has to do with the collection of water in the crust of the earth, which is tapped when wells are sunk.

Ordinary wells are dug out by hand to the depth of from thirty to seventy feet, and the water out of the soil in which they have been made soaks into them. There is no attraction for water on the part of the well; but in the natural course of things, the water derived from the rain on the surface moves downwards and sideways into the earth, and falls into cracks and cavities, such as wells, when they come in the way. Usually such shallow wells as these only supply a moderate quantity of water, and are apt to become dry if there has been no rain for some time. Other wells have been invented to supply a constant flow of pure water almost to an unlimited extent even during long droughts. Water goes on sinking through the earth until it comes to a rock or bed of earth very much denser and harder than those it has got through. The water stops on the top of the hard earth, and although much goes through it during the lapse of time, still there is always a great mass of wet earth on the top. The hard stratum, as it is called, may be hundreds of feet in the earth, and the quantity of water immediately above it depends upon the extent of the stratum, and whether it is quite flat or not. If there is not much of the hard stratum there will not be much water, and if it is flat the water will tend to run off sideways. But very often the stratum is in the form of a basin, and then the water is kept within certain bounds, and if it can be got at, the supply is enormous, because the rain of centuries has collected, and any loss is made up by the gradual passage downwards of the rain which occurs throughout a whole year. London is built upon a thick clay covered with gravel, and the rain sinks down through the gravel on to the clay, which is denser and much less easily passed by water. Thus the usual house wells reach water on the top of the clay. The clay is a huge mass, situated in a basin-shaped cavity, miles in extent, in the chalk; and between the clay and the chalk there are some sands. Now, the water has gone on collecting through the clay and sands on top of the hard chalk, and by sinking wells into the chalk London has been supplied with pure water at the rate of 20,000,000 gallons and more a day. The wells are called artesian because they were first attempted to be made at Artois, in France, and some have had to be formed at prodigious depths. At Grenelle, near Paris, a well was sunk to the enormous depth of 1,600 feet, and yet no water came; but at 1,800 feet a hard stratum was reached, for they pierced quite through the chalk, and got to a hard green sand. Then the water rushed right up to the surface, and overflowed at the rate of half a million gallons a day. Moreover, it was warm.



AN ARTESIAN WELL, SHOWING THE WATER RISING.

Of course these wells are not dug out by men; but a machine is used called a borer. It is a bar of iron with a scoop at the lower end like a gimlet, and a place for another bar to be screwed in at the upper end. The bar is placed in the earth and turned round by steam power, and after having been twisted round a few times, it is brought up to the surface, and the scoop is cleaned out. When any great depth is reached this is a very troublesome affair, for fifty, sixty, or more rods have to be screwed and unscrewed every time a few inches of earth are removed. The bore made for the well is thus very small, and is lined with pipes for a long distance down. When once water is got, the supply never fails. The water generally rushes up when the hard stratum is reached; and when a well of this kind was sunk at Chiswick to a depth of 620 feet, the water rose four feet above the level of the ground. At Tooting so much water rose that a sufficient stream was obtained to turn a wheel. The French government has sunk artesian wells in the desert of North Africa, and many fertile spots now exist in the midst of that waste. In sinking these wells some very curious things were brought up by the rush of water, showing that water circulates underground from place to place. A well in the Sahara desert, 156 feet deep, produced some small fish, three or four inches long; yet the nearest stream was many leagues off. Fine sand with vegetable matter in it, branches of thorn several inches long, and the stems of marsh plants have been thrown up from great depths. It must be noticed that the very deep wells throw forth water warmer than that of the surface. There are some natural springs which are constant, and from the warmth of their water we may believe that it comes from a great depth, up through natural artesian wells in the form of cracks.

The Bath waters rise to the surface and are very hot—too hot to bathe in comfortably. Their temperature is 120° Fahr., and they contain mineral substances dissolved out of the earth. Such is the abundance of the supply that it has been calculated that if the water were evaporated during a whole year, the solids left would form a column nine feet thick and 140 feet high. Some hot springs in Italy near San Filippo contain immense quantities of dissolved solid matter, principally consisting of chalk, Epsom salts, and plaster of Paris. Some of the water flows into a pond, and during twenty years a mass thirty feet thick of these substances was left at the bottom. A hard stratum of stone about a foot thick is often produced by the overflow of the water in four months. These hot springs are sometimes influenced by earthquakes; during the great Lisbon earthquake, a spring in the Pyrenees was suddenly changed from a cold spring to one of 122° Fahr., and it has retained this warmth ever since.

PICTURES IN STONES.

Many curious and wonderful things are to be found in stones. Sometimes they contain relics of a life which has long passed away; at others, the elements of which they may be composed are massed together in very remarkable forms, as if art had had more to do with them than nature. Pick up a pebble by the sea-shore, its exterior may be rough and unattractive, but in its interior may be embalmed the remains of the most delicate animal or vegetable organisation, which the art of the lapidary will very soon reveal; or, though containing no such remains, the stone may be found to display a distinct resemblance to a landscape or a fortification, and prove a fine specimen of what are therefore termed by the lapidaries "landscape" or "fortification" agates.

The curious markings in stones were observed in ancient times, and many of them were ascribed to a supernatural origin. We read of one which bore a remarkable likeness to the head of a crowned king; of another in which was seen a man in the attitude of running; but the most remarkable of all was an agate containing a representation of Apollo surrounded by the nine Muses! We may perhaps be inclined to doubt whether it was not a strained fancy which discerned some of these objects; but several very remarkable specimens are to be found in the cabinets of jewel-collectors; some of the finest in this country are in the possession of Mr. Beresford-Hope, and were lent by him for exhibition at the South Kensington Museum, and an inspection of them serves to show how closely Nature, in her freaks, sometimes imitates the art of man.

Among these articles is a series of specimens of agates, Mocha-stones, &c., many of which contain natural representations of the human face. So lifelike are some of these that they might be taken at a hasty glance for medallion portraits. There is one which closely resembles a lady laughing, and in its general character strongly reminds the beholder of one of those last-century portraits which are often seen in family collections. The only thing to recall the fact that it is not really a miniature, is the strongly marked background, which, being formed of opalescent stone, is too prominent and highly coloured to accord with the idea of artistic workmanship.

But this objection does not apply to some of the other stones. In one we see the head of an old man which looks like nature itself. The eyes are drooping, and the expression of the face is calm and meditative; the hair and beard are white as with the frosts of some seventy or eighty years; and the whole character is extremely venerable. The background here is dark and of a uniform tint, which is admirably suited to the proper throwing up of the figure in the centre.

There is also a very curious one which we are strongly impelled to term a "cabinet picture of a lady," in hat and walking costume, the arm thrown back, the attitude very animated, and the face extremely good. There is an indistinctness about the marking of this stone in some portions, which, keeping up the illusion that it is a work of art, gives one the idea that it is a hasty and unfinished sketch, but done by no unskilful hand.

These three stones we have described, are perhaps the most striking in the collection; but there are others scarcely less curious. One very closely resembles the head of a young lady in an attitude of devotion; the eyes are directed to the sky, the hair thrown down the back; the skin is of transparent whiteness. Another looks like the head of a Romish ecclesiastic. In a third there is a bald-headed man, whom at first sight we seem to recognise as an old acquaintance. On another there is the head of a horse, rather rough, but very distinct in its general outline.

of the Atmosphere.

EFFECTS OF FROST.—During one of Franklin's voyages, the winter was so severe, near the Coppermine River, that the fish froze as they were taken out of the nets; in a short time they became as solid as ice, and were easily split open by a blow from a hatchet. If in the completely frozen state they were thawed before the fire, they revived. This is a very remarkable instance of how completely animation is sometimes found suspended in the case of cold-blooded animals.

POWER OF AIR CURRENTS.—The following curious phenomenon, showing the existence and power of currents and counter-currents in the air, was observed during the eruption of a volcano in the island of St. Vincent in 1812. Though the trade wind continually blows from Barbadoes to St. Vincent, yet ashes thrown to a great height were carried from St. Vincent to Barbadoes. In 1815, during the eruption of Sumbawa, in the island of that name, ashes were borne to the islands of Amboyna and Banda, 800 miles distant from and *east* of the site of the volcano, and during the height of the *south-east* monsoon.—*Sir Charles Lyell's "Principles of Geology."*

SEVERE COLD.—That the great cold often experienced in the month of April in our temperate latitudes is not confined to modern times is shown by the following extract from Stow's "Annals":—"And heere is to bee noted that the 14 day of Aprill, and the morrow after Easter Day (1356), King Edwarde with his hoast lay before the Cittie of Paris, which day was full darke of mist and haile, and so bitter cold, that many men dyed on their horsebackes with the cold, wherefore unto this day it hath been called the Blacke Monday."

SALTNESS OF THE SEA.

THE saltness of the sea is one of those wonderful facts which we are apt to take for granted, without inquiring as to the cause of which it is the effect. That the sea is salt everybody knows; but why salt? Why are not rivers salt also? The degree to which saltness pervades sea-water varies. Some parts of the ocean are saturated with saline matter, others are almost brackish. The water of the Caribbean sea is dense compared with that of the Baltic in the proportion of 0·12 to 0·19. The kind of salt, however, to be found in sea-water is universally the same, whatever the density of the water may be. Local causes may affect water to a certain extent, but experience shows that the salts extracted from sea water, in whatever part of the world, are substantially the same in kind, the only difference being in the quantity. The salts contained are:—Chloride of sodium (common salt), chloride of potassium, chloride of calcium, chloride of magnesium, bromide of magnesium, sulphate of lime, carbonate of lime (common chalk), sulphate of magnesia, carbonate of magnesia.

The actual contents are set out in full because there is a common belief, founded on a confusion of terms, that common table salt is the only saline ingredient in sea water. As regards the aggregate quantity of salts contained, some idea may be formed of it by stating that if all the salt contained in the water annually evaporated from the north-east trade region of the Atlantic, could be heaped into one place, it would cover an area equal to the size of the British Islands, to the depth of fourteen feet.

A moment's reflection will serve to show that in latitudes where there is great evaporating power, and but slight diluting influence, the sea water must necessarily be rich in salts; and that in latitudes where the contrary conditions exist, the water must be poor. That such is the case has been proved, and it is attested among other signs, by the colour of the water, which in rainy sunless districts, is of a light green; in rainless, sunny places, of a deep blue-vitriol blue. The compensatory balance between briny water and brackish is kept up by a system of currents, which pervades the whole ocean. These currents, running from the north to the south, and from the south to the north, are the means of equalising, to some extent, the charge of saline properties which the waters respectively hold in solution, the water of the cold climates being strengthened by the heavily-laden salt streams from the south, the southern waters being refreshed, as it were, with a drink from the comparatively fresh waters of the north. But after all has been done, the equatorial seas are still so rich in salts that they have a superabundance, and are glad to be rid of their burden

to anything that requires it. An abundant demand is kept up by the myriads of coral creatures which live and move and have their being in the tropical seas, and require for the purposes of their work an amount of calcareous and saline matter, proportionate to that which the over-burdened waters have to spare. The excess is drawn by them on demand, and appropriated to those manufactures which these small workers undertake to the glory of their Maker.

The source of sea salts is to be found in the washing of the coast and in the contributions which rivers bring. Rivers, in their way to the sea, gather from brooks, springs, surface drainings, and other such sources, a great quantity of soluble matter; they wash down, also, a considerable amount of earth which the sea water can, though they cannot, dissolve. Into the great reservoir of the ocean they fling their silty cargo, which is absorbed in the pores of the water, and is then distributed by means of the ocean circulatory system already adverted to.

The sea is salt by reason of the earth washings poured into it; it has different densities because of the influence of rainfalls, rivers, and evaporation; it is prevented from stagnating by a universal system of ocean-currents; and it yields out of its abundance material for the building up of continents to be. Such are the facts and conclusions involved in the consideration of the saltness of the sea.

THE WASP.

THE ancient Egyptians manufactured from the papyrus the first paper that was ever produced by human hands, and the manufacture has been since improving until it has reached its present state of perfection. But long ere the reed which the Nile banks produced had ever been employed for this purpose by the art of man, the wasp had attained perfection as a paper manufacturer. So great is the present consumption of paper, that new substances are being eagerly sought after that may supplement the supply of rags, which is now so far from being adequate. It has been attempted to make paper from the fibre of wood: this is an art in which the wasp has excelled for countless centuries. He manufactures from wood, which is apparently so unpromising a material, a paper of surpassing fineness and delicacy of texture.

The wasp is not generally looked upon with much favour; indeed, he rarely gets any quarter. It is certainly a severe trial to the temper, when you pull a plum, to find that this insect has already taken possession of the fruit, and to have your attention somewhat forcibly drawn to the circumstance by a fierce sting on your finger. The natural and pardonable impulse is to visit the aggressor, and all his kith and kin, with the most condign punishment. Two of a trade never agree—the wasp and the human being are both fruit eaters, and fall out in consequence.

Yet, notwithstanding our natural hostility to the wasp, there are many circumstances with reference to himself and his history that form most interesting subjects for study, and many naturalists have devoted a great deal of attention to the matter. The sting which we fear with such good reason is a very beautiful apparatus. It is a very minute tube, at the end of which, in the body of the wasp, is a small bag, in which a store of the poisonous fluid is kept. When the wasp is irritated, he darts the little tubular sting into the offender, the small bag is compressed, and a drop of poison is inserted. Generally this is only felt as a sharp pain for a little time, but occasionally much more serious consequences have ensued from it.

In our illustration is represented the nest, or vespiary, as it is sometimes called, of the wasp, suspended from the branch of a tree: these nests are much finer and closer in texture than those which are buried under the ground, which are the most frequently met with; but the method of construction is much the same in both cases. The history of the formation of one of these nests is as follows:—A female wasp which has survived the winter that has proved fatal to the males, seeks in spring for a suitable spot. She selects a hole in a bank, or in a thatch, or sometimes a bush, as the scene of her labours. Here she commences to make her nest. Her materials are paper, and this paper, as already mentioned, is made of wood. The wasp has been seen sitting on a window-sill tearing off shreds of wood, collecting them into a bundle, and flying away with them. She has been further traced in the process of comminuting them, adding to them a glutinous secretion, making a mixture which, spread out in layers, forms the paper. With these layers of paper she commences the globular nest. It is coated all round with many layers of the paper, and contains inside a number of combs, somewhat resembling those of a bee-hive, except that they are ranged vertically, while the combs in a wasp's nest are horizontal.

After the female has completed a certain portion of the nest and constructed a number of cells, she deposits an egg in each. These eggs are shortly hatched. She then supplies the young with food. This consists of various sweet morsels, portions of fruit, honey stolen from the bees, and particles collected in visits to sugar casks. As soon as the young have reached maturity, on them devolves the entire duty of finishing the home, and of nurturing the grubs. There is but one queen wasp in each nest, the others being either males or workers, and she alone lays eggs, so that all the population of the vespiary are her offspring. The

young wasps which are to form future queens—to be the parents of other nests in the succeeding seasons—are fed differently when young from the queens. Their duty appears to be to discharge certain menial offices connected with the internal economy of the nest.

NEST OF THE TREE WASP.

ordinary workers; they have an allowance of animal food consisting of insects which have been captured, or of fragments of meat purloined from the butcher's stall or elsewhere. The males are than the workers, but are not so large as the

Wasps have not the foresight of bees; they lay up no store for winter, consequently the great majority perish; in fact, it is said that the workers actually put to death all the young grubs at the approach of winter.

BRICKS, AND EXTRAORDINARY BRICK BUILDINGS.

THE history of brick-making of necessity includes an account of some of the most remarkable structures of all ages, and hence becomes a subject of universal interest.

Bricks must be divided into two classes, the burnt and the unburnt; and though the unburnt would hardly appear worthy of mention in a country like England, so subject to heavy rains, and with so humid an atmosphere, still the enormous structures that have been raised in unburnt bricks in other countries must entitle them to mention. The ancients both baked their bricks and dried them in the sun. Among the oldest specimens of bricks are those in the ruins of Babylon, and it does not seem improbable that the moulding of unburnt bricks was discovered in a few generations after the creation. We find that unburnt bricks, impressed with a pattern, were used at a very early period, some of the oldest remains of building being in this material.

The Nineveh palaces were built of unburnt bricks formed of loam and straw. The walls were in many instances fifteen feet thick, lined with the sculptured slabs of alabaster now in the British Museum; and it is the falling in of these walls, and their being again converted into earth, that has so wonderfully preserved these sculptures.

The Assyrians and Babylonians used both sun-dried and kiln-baked bricks for building; and through the researches of Sir H. Rawlinson, Mr. Layard, and M. Botta, the inscriptions on them have been deciphered, recording not only the name of the reigning king, but sometimes his genealogy and the name of the place where the building stood. Thus the inscription on the bricks at the oldest palace at Nimroud reads:—"This is the palace of Asaradenpal, the supreme ruler, king of Assyria; of Abedbar, king of Assyria; son of Pul, powerful king of Assyria."

Xenophon speaks of the city of Larissa being walled with potters' bricks, supposed to be unburnt bricks. "This wall," he says, "was twenty-five feet thick, built on a stone plinth ninety feet in height." The latest discoveries at Nineveh have shown us a similar wall upon a stone plinth. In Mexico, the Teocallis, or gods' houses, are built, or at least faced, with bricks, generally believed to be unburnt. One of these Teocallis, near Cholula, is in the form of a square truncated pyramid, and is formed of four terraces; its whole height is 177 feet. Each side of the base is 1,423 feet, twice the length of the great pyramid of Cheops. Its base covers forty-four acres, and its truncated top contains more than one acre.

In Egypt there are many small pyramids of unburnt bricks, at Dashour and Thebes the bricks being formed of loam and chopped straw. Many of these bricks are stamped or moulded with figures and hieroglyphs, and it is very probable that it was for the building of these pyramids that the Israelites were employed in making bricks, as described in Exodus v. 2.

Among the Greeks, we learn from Pausanias of Agis besieging the town of Mantinea, which was walled with unburnt bricks, and which he overcame by turning the river against it, which dissolved the walls. It is recorded that Nineveh, under Sardanapalus, was destroyed in a similar manner. Pausanias, too, tells us that walls of unburnt bricks resist the battering-ram better than stone walls; while Pliny says that walls of this material are less affected by earthquakes than other walls; and we have found in our attacks on the Russian fortifications that earthen walls are not less adapted for modern warfare.

The burning of bricks and the use of mortar seem to imply so great an advance in civilisation that we should hardly expect to find burnt bricks used before some thousand years had elapsed from the creation; and the first mention that we find of it is in Genesis, for the building of the Tower of Babel (Genesis xi. 3, 4)—"Let us make bricks, and burn them throughly. And they had brick for stone, and lime had they for mortar. And they said, Go to, let us build us a city and a tower whose top may reach unto heaven." The description given by Herodotus agrees with this exactly. "Here I think I ought to explain how the earth out of the moat was consumed, and in what manner the wall was built. As they dug the moat they made bricks of the earth that was taken out, and when they had moulded a sufficient number they baked them in kilns; then making use of hot asphalte for cement, and laying wattled reeds between the thirty bottom courses of bricks, they first built up the sides of the moat and afterwards the wall itself in the same manner." Walls have been found in Babylonia built exactly in this manner, with asphalte and wattled reeds.

The next record of brick-making is contained in the early chapters of Exodus, or about 750 years later, when, notwithstanding the time which had elapsed, bricks appear to have been no longer burned, but simply baked in the sun, and straw was mixed with the clay of which they were composed. This is expressly affirmed by Philo ("Life of Moses"), who was himself a native of Alexandria, in Egypt, and who says, in describing the oppression of the Israelites, that some were obliged to work in clay, and others to gather straw for the formation of bricks, "because straw is the binding of the brick."

Xenophon, in his "Anabasis," gives an account of the wall of the Medes. "It was built," says he, "of burnt bricks laid in asphalte, twenty feet thick,

100 feet high, and its length was said to be about sixty-seven miles long."

Diodorus Siculus mentions the walls of a palace at Babylon as being of burnt brick, carved with men and animals, all painted in the natural colours; but it is not very clear whether these were not all in raw tints, as those at Nimroud. Herodotus gives a similar description of the walls of Ecbatana. The use of bricks in colours painted and burnt in, was doubted until the discoveries of Layard and others, when specimens of burnt bricks were found at Nimroud, painted in white, yellow, green, and black enamel. Cones of baked brick, with inscriptions and hieroglyphs, are found in Egypt and Babylonia, the inscriptions on much of the Babylonian work being so fine as scarcely to be deciphered without the aid of a magnifying-glass.

CONNECTION BETWEEN FOOD AND ANIMAL ENERGY.

Baron Liebig thus explains the principles which govern the relation between the food of man and his warmth and activity in different latitudes of the earth.

In the animal body the food is the fuel; with a proper supply of oxygen we obtain the heat given out during the combustion of that fuel. In winter, when we take exercise in a cold atmosphere, and when, consequently, the amount of inspired oxygen increases, the necessity for food containing carbon and hydrogen increases in the same ratio; and by gratifying the appetite thus excited, we obtain the most efficient protection against the most piercing cold. We expire more carbon at a low than at a high temperature, and require more or less carbon in our food in the same proportion. Consequently, more is respired in Sweden than in Sicily, and in our own country an eighth more in winter than in summer.

Even if an equal weight of food is consumed in hot and cold climates, Infinite Wisdom has ordained that very unequal proportions of carbon shall be taken in it. The fruits used by the inhabitants of southern climes do not contain in a fresh state more than twelve per cent. of carbon, while the blubber and train oil, which feed the inhabitants of the polar regions, contain sixty-six to eighty per cent. of that element. From the same cause it is comparatively easy to be temperate in warm climates, or to bear hunger for a long time under the equator; but cold and hunger united very soon produce exhaustion. A starving man is very soon frozen to death.

Our clothing is merely an equivalent for a certain amount of food. The more warmly we are clothed, the less urgent becomes the appetite for food; because the loss of heat by cooling, and consequently the amount of heat to be supplied by the food, are diminished. If we were to go naked, like certain savage tribes, or if in hunting or fishing we were exposed to the same degree of cold as the people in Arctic latitudes, we should be able with ease to consume half of a calf, and perhaps a dozen of tallow candles into the bargain, daily, as warmly-clad travellers have related with astonishment of some of these people. We should then also be able to take the same quantity of brandy or train oil without bad effects, because the carbon and hydrogen of these substances would only suffice to keep up the equilibrium between the external temperature and that of our bodies.

It appears then, from what has been said, that the quantity of food required is regulated by the number of respirations, by the temperature of the air, and by the amount of heat given off to the surrounding medium. The unequal loss of heat in summer and winter in cold and hot climates is not the only cause which renders necessary unequal quantities of food. There are other causes, such as bodily exercise, and all kinds of labour and exertion. The consumption of mechanical force in the body is always equal to a waste of matter in the body, and this must be restored in the food. When a man or an animal works, a certain amount of food must be added; increased work and effort without a corresponding increase of food, cannot be continued for any length of time.

THE POWER OF SOUND.

There is an anecdote related of Rubini, the great tenor singer, which illustrates the peculiar power of the human voice. In an opera by Pacini, called "Il Talismano," in which Rubini was singing, he had to sing a phrase in which a high B flat occurs, which he was accustomed to attack and hold out with great power, to the delight of his audience. The public flocked to hear this wonderful note, and never missed calling for a repetition of it. Rubini had already sung the note on seven previous occasions, each time twice, and on one evening, when an admiring audience waited for the production of the wonderful note, Rubini was dumb. He opened his mouth, extended his arms, and tried to utter the note which would not come. The audience cheered, applauded, and encouraged him in every way, but the obstinate B flat refused to be sounded. One more effort, and the force of his powerful lungs overcame the obstacle, and the B flat rung among the audience with brilliant vigour; but something in the mechanism of his voice had given way, and, though feeling acute pain, he continued the scene, forgetting his suffering in the triumphant conquest he had obtained. When he left the stage, he saw the surgeon of the theatre, who examined him, and found that in the exertion of producing the obstinate note, he had actually broken his collar-bone.

Exercising a little caution in his acting, he positively sung through the remainder of the season with a broken clavicle, very few of the audience discovering that he had suffered any injury in his endeavour to please them. The whole story is fully set forth in Sutherland Edwards' "History of the Opera," vol. ii., p. 268.

Another authentic instance of the power of sound took place during the rehearsal of the music for the Duke of Wellington's funeral in 1852. The story is related by a personal friend of the writer, who was present on the occasion. The rehearsal took place in one of the parish churches near to St. Paul's Cathedral, the whole available space being filled with singers, and during a passage in unison in an anthem written by Mr. John Goss for the occasion, called "A Prince is fallen in Israel," at one note sung loudly by all the voices, some six or eight of the gas-glasses echoed the sound, and burst into fragments.

Chéron, a celebrated French bass singer, could break a tumbler into a thousand pieces, by sounding into a thin glass the fundamental note it naturally gave out. Ivanoff, the Russian bass, could also do the like.

Sir David Brewster, in his "Letters on Natural Magic," says, "Buildings have often been thrown down by violent concussions of the air, occasioned either by the sound of great guns, or by loud thunder, and most serious effects upon human and animal life have been produced by the same cause." Most persons have experienced the stunning pain produced in the ear, when placed near a cannon that is discharged. Deafness has frequently been the result of such sudden concussions, and if we may reason from analogy, death itself must often have been the consequence. When peace was proclaimed in 1697, two troops of horse were dismounted and drawn up in line, in order to fire their volleys. Opposite the centre of the line was the door of a butcher's shop, where there was a large mastiff dog of great courage. The dog was sleeping by the fire, but when the first volley was fired, it immediately started up, ran into another room, and hid itself under a bed. On the firing of the second volley, the dog rose, ran several times about the room, trembling violently, and apparently in great agony. When the third volley was fired, the dog ran about once or twice with great violence, and suddenly fell down dead, throwing up blood from his mouth and nose.

MUMMIES.

THE preservation of dead bodies in an uncorrupted state was one of the principal arts of ancient nations, while with some it was also a sacred duty. Prescott says that the Peruvians were in the habit of placing the bodies of their dead upon the high levels of the Andes, where the continuousness of the draught of pure air acted as an antiseptic, and prevented natural decay. In deserts, corpses have been found, presumably hundreds of years old, preserved by the action of sand and wind; and it is known that in the Arctic regions the intense cold of the atmosphere acts as a preservative against corruption; but in both cases equally, the preserved bodies have been the result of accident rather than design.

A MUMMY CASE.

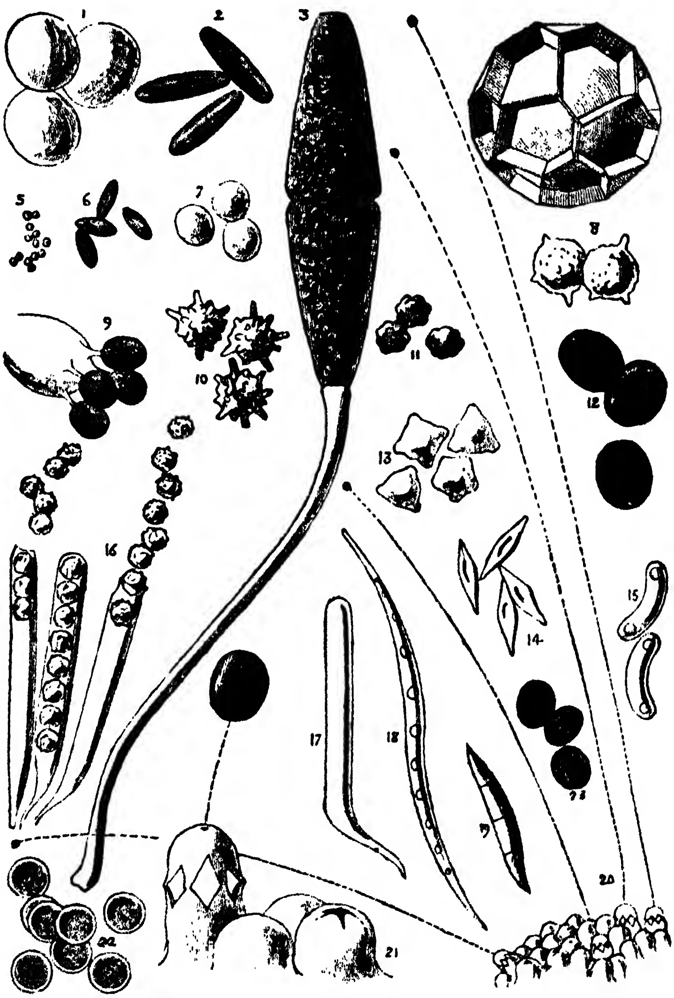
The Egyptians were of all people the most particular about insisting on the preservation of their dead bodies, and the most skilful in carrying it out. They used to keep the bodies of their ancestors, embalmed, in little houses, beautifully adorned, and took great pleasure in beholding them, as it were alive, without change, with "no hint of death in all their frame." Testimony to their skill in embalming is borne by the many mummies that remain even to this day, many of them being upwards of 2,000 years old. They used several processes for embalming. In one process they scooped out the brains at the nostrils with an iron scoop, and injected medicaments into the head to supply their place. They took out the intestines, and having filled the body with myrrh, cassia, and other spices, pickled it in nitre, in which it soaked for seventy days. The corpse was then wrapped in swathes of fine linen and gums, and these were covered again according to fancy, with robes and tissues, or were simply placed, as it were, in bed in the dead-room.

Another process, used for inexpensive embalming, was to inject a liquor extracted from the cedar-tree, into the body of the dead, which caused the corrupting elements to come away with the liquor. The body was then wrapped in a winding-sheet containing a quantity of salt of nitre, and so was preserved for a time; but this process, as it was not so costly, was not so durable as the other. The modern process of embalming is different from both of these, and though very successful cases of preservation have been effected by it, it is to Egypt that must be ascribed the greatest excellence in the mummy-making art.

THE SEEDS OF MUSHROOMS AND TOADSTOOLS.

EVERY plant in the vegetable kingdom, as a rule, springs from and produces seed. Mushrooms, toadstools, and other fungi are no exception, but their reproductive bodies are termed *spores*, and though they are truly analogous to seed, they differ from it in structure. Spores, therefore, may be understood as reproductive bodies without an embryo; the embryo being the minute rudimentary plant invariably found within true seeds.

Some spores of fungi are so inconceivably minute that it would require more than 200,000,000 placed side by side to cover a square inch, yet these atoms, insignificant as they appear, keep constant to particular patterns, both in shape, size, and colour. More than this, each atom is possessed of a spark of life, which, under favourable circumstances, will cause the minute spore to swell and burst and reproduce the parent plant from which it sprang. It is difficult, if not totally impossible, to conceive the infinite minuteness of these living bodies, but for comparison, we may say that one spore bears the same relation to a foot linear as a yard does to more than 100 miles; a space four inches square is sufficient to contain a number of spores, side by side, equal to all the inhabitants of the world; 1,000,000 would find ample space on the head of a pin; yet the life contained in these objects is so tenacious that neither the burning sun of summer nor the severest cold of winter causes them to lose their vital power. When they have freshly fallen from the parent plant, they are highly sensitive, and if they are allowed to fall upon glass and are watched under the higher powers of the microscope, a breath will show in a remarkable manner how they are influenced by warmth and moisture. Fig. 5 shows some of these minute spores (drawn direct with a *camera-lucida* attached to the microscope) from a large species of fungus (*Lentinus vulpinus*) found attacking elms at the north of London. Sowerby described this fungus more than half a century ago, but it still continues to attack elms in the same district, no vicissitudes of weather being sufficient to destroy the life of the spores.



MINUTE FUNGI.

The spores of different species of fungi vary greatly in size, shape, colour, and quality. Some are more than a hundred times larger than others; they take all sorts of geometrical and ornamental forms, as shown in our engraving, where a collection of spores is enlarged from nature to the same scale; many are white, some blue, green, brown, red, yellow, or black; many are sculptured and ornamented in a remarkable manner; and whilst some are perfectly harmless, others are violent poisons; of

the latter, Figs. 6, 7, and 10 are especially dangerous, being spores of *Agaricus euosmus*, *Agaricus muscarius*, and *Lactarius acris*. A few spores of the latter placed on the tongue are so pungent, bitter, and acrid as to be perfectly unbearable. Fig. 9 shows the purple-brown spores "in situ" of the edible mushroom of our pastures. In the mushroom family the spores are invariably arranged in fours, on slight threads attached to privileged cells. Some spores are always dry, and may be dispersed with a breath; others are as constantly covered with a viscid coating, which glues them to whatever object they may happen to fall upon; some are fœtid, but the majority are fragrant, and may be and are inhaled by millions without apparent inconvenience. The spores of some species of fungi, as the puff-balls, may often be seen to rise in the air like a column of smoke. When a dry puff-ball is kicked aside the spores are dispersed in millions, and such as do not light upon a suitable *nidus*, of course perish. A representation of a spore from a starry puff-ball is shown in Fig. 8. As many species of fungi are peculiar to certain objects, the difficulty at times of finding a proper place on which to germinate must be great, some species being confined to dead caterpillars, others to horses' hoofs, acorns, fir-cones, wine-cellars, old leather, or plaster walls. The black spores of an agaric found only in the latter situation are shown in Fig. 23. Some spores are greedily devoured by minute insects, whilst others are invariably avoided as distasteful to them.

Some subterranean fungi, as the truffle of our markets, produce their spores beneath the earth, and they never reach the light unless rooted out by hogs, squirrels, or the dogs of the truffle-hunters. These spores are especially elegant, a representation of one species being given in Fig. 4. A large division of fungi contain their spores in innumerable sacs, called *asci*, eight in a sac; and when the fruit is ripe, the spores are discharged through an orifice at the top, as in Fig. 16; but what motive power there is to eject the spores with such force is not known, the whole ascus, or sac, sometimes being only the four-hundredth part of an inch in length.

There is a fungus (*Sphærobolus stellatus*) common on rotten wood in autumn, remarkable for the way in which it disperses its spores. It consists of two coats—an outer and inner—the latter containing a sporangium, or spore-case. When the fruit is ripe, the outer case suddenly cracks in a stellate manner, and the inner lining becomes violently inverted, as in Fig. 20, which is again shown to a larger scale in Fig. 21. This sudden movement of the fungus projects the sporangium containing the spores with great force into the air. The sporangium is glutinous, and attaches itself to whatever it touches, whether the leaves above or the ground below. If the fungus is examined, it is probable that several will be projected on to the face of the observer.

When fungi spores have germinated, and the parent plant has been reproduced, the fungus will sometimes live many years, as is the case with the woody species common on oaks, &c. At other times the perfect plant lives but a few hours, or is no sooner perfected than it dissolves away—such as *Coprinus fimetarius*, a slender, fragile little agaric, common on heaps of horse-dung. It lasts a very short time, coming up in the night, and perishing before mid-day, and its comparatively large black spores are shown in Fig. 12. The figures not yet referred to are Fig. 1, spores of an agaric (*Agaricus mucidus*), common on beeches—abundant in Epping Forest. Fig. 2, spores of *Gomphidius viscidus*, common in fir woods. Fig. 3, *Podisoma juniperi-communis*, common on juniper trees. Fig. 11, spores of *Hydnum imbricatum*—edible. Fig. 13, pink spores of *Agaricus pascuus*—probably poisonous. Fig. 14, spores of *Boletus parasiticus*, a fungus parasitic on another species. Figs. 15, 17, 18, and 19, spores of minute black fungi belonging to the genus Sphæria. Fig. 22, a group of the minute red discs found floating in human blood, to which they impart the red colour; drawn to the same scale as the spores, for comparison with them.

We only judge of size by comparing one thing with another; an object thus becomes small as we compare it with something larger. If then, after considering these wonderfully minute organisms, where hundreds of millions of perfect objects go to a square inch, we turn for a moment to consider the sublime magnitude of the stellar universe, where our whole solar system is reduced to a mere dot in the universe, we cannot but regard with reverential admiration the consummate perfection of all created things.

Ingenuity of Uncivilised Races.

INGENUITY OF THE TAHITANS.—In all my experience (says Mr. Pickering) I have never met with a people so serviceable to the traveller as the Tahitans, for they seemed, in fact, to command at all times the principal conveniences of life. Half an hour of daylight was sufficient for building a house of the stems and leaves of the fehi banana, and fire was produced by rubbing sticks. In one place the running water was deeply sunk among stones, but by working in banana-leaves they brought it to the surface. The chase of eels, which in these dripping mountains become almost amphibious, offered another instance of their ingenuity. They also tore off with their teeth the fibrous bark of the "puran" (*Hibiscus tiliaceus*) and a moment after applied it to noosing small fish. If one was sent for fruit, he would usually

make a basket on the way, by plaiting the segments of a cocoa-nut leaf. A mat was manufactured with almost equal ease. Clothing was always at hand, and a banana-leaf served for an umbrella, or in fine weather they would wear garlands of flowers. Tumblers and bottles were supplied by single joints of the bamboo, and casks or buckets by the long stems; and whether we asked for a hatchet, knife, spoon, tooth-brush, or wash-basin, we never found our guides at fault.

Bee-hunting by the Natives in New South Wales.—Having seen a bee alight on any twig or leaf, the black takes a little bit of the finest down of a feather, and rolling it up between his fingers at one end, cautiously steals upon the bee, and dexterously places the down upon its back, to which the honey makes it adhere. Away soars the bee at once, high into the air, and away soars the savage's eye after it, his head being thrown back, and his whole gaze concentrated upon that one speck in the sky. As the bee advances, the black keeps as nearly under him as possible, careering along at full speed, stumbling over boughs and bushes, leaping over bogs and holes, and heedless of scratches and bruises, and everything else but the speck of white down which is guiding him to the lofty gum-tree, in the topmost boughs of which lies his dinner for that day. Having traced the bee to his retreat, he procures a quantity of clean string bark, which he tears up into a mass resembling dried moss, or, more nearly still, the fibres of the cocoa-nut husk when torn. This is to place the honey upon. He then, with his tomahawk, cuts his way up the tree, cuts into the hollow branch where the hive is, feasts on it himself, and takes the remainder down in the stringy bark, which, if much adheres to it, he afterwards sucks, so that nothing may be lost.—*Henderson's "Excursions in New South Wales."*

FLOATING ISLANDS.

Of the chief characteristics of the great rivers of Asia and America, not the least striking are their rafts or floating islands. After the spring floods and periodical inundations, the rapid current of the stream makes itself felt with destructive force upon the softened soil of the banks and of the numerous islands with which the river is studded. Many of the latter are often swept wholly away, so that large quantities of vegetable matter—sometimes several acres at a time—are precipitated into the stream. Large trees are often to be seen floating with their tops above the water, their branches and their roots interlaced, so as to form floating islets. They are called "camelotes" in Spanish, and to these—especially in the river Parana, where great masses of cane and brushwood are brought away—many animals swim off for refuge during the floods; and curious is the mixture sometimes of the refugees, the natural antipathy to each other being overcome by their common danger.

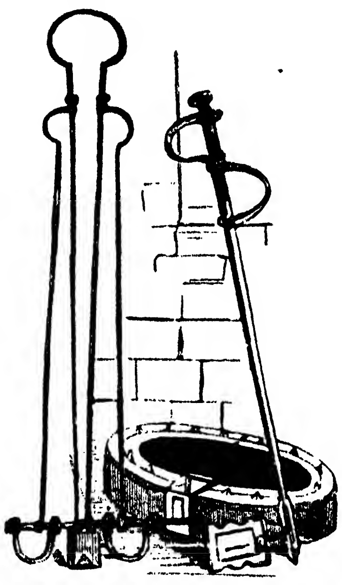
Sitting by the side of some grave-looking storks or water-fowl, may be seen a group of monkeys or squirrels; or a tiger-cat, or puma, in close companionship with an alligator or a large serpent. They are often carried down the river to the towns and villages. Four tigers were landed in this manner in one night at Monte Video, to the no small consternation of the inhabitants, who found them prowling about the town on the next morning. These islands thus laden are sometimes carried far out to sea, and have been seen at fifty and one hundred miles from the mouth of the Ganges. They are also to be met with among the Moluccas and Philippine Islands—especially after hurricanes—and have been mistaken by ships for land. But it is rarely that they are allowed to proceed uninterrupted on their voyage. Either they are stranded by a shoal or an island in the middle of the river, or are anchored in the muddy bed of the stream by the roots of the larger trees of which they are mostly composed.

When once the islands become fixtures, they quickly increase in size by the numerous additions that are continually made to them, and soon a natural bridge or raft is formed across the river. In climates where Nature is so lavish of her favours, the mud with which the waters are so thickly impregnated, and the soil brought away in the roots of the trees, soon convert the logs of drift-wood into floating islands of shrubs and trees and flowers, where all kinds of birds, snakes, and alligators make their home. The navigation of the river is often entirely impeded in this manner. One of these verdant rafts in the Atchafalaya—an arm of the Mississippi river—went on increasing for a period of forty years, and so large became its dimensions, that its length was ten miles, its width 220 yards, and its depth eight feet. It was covered as usual with a luxuriant vegetation, bushes and many varieties of flowers grew upon it, and some of its trees reached the height of sixty feet. Though stationary, it rose and fell with the tide, and so effectually did it close the navigation of the river that it took four years to clear it away.

In the same manner the Red River was for some time rendered almost unnavigable, and the Rio de la Plata is gradually filling up from the vast quantity of matter that is annually poured into it. The formation of the delta of the Mississippi is materially assisted by these floating islands. The river does not empty itself into the sea in one continuous channel, but in a variety of arms or mouths, formed by the mud and drift-wood brought down by the river and its tributaries. These become at first great swamps, but as the vegetation increases, they rise gradually higher and higher above the level of the waters.

TORTURE.

THE ingenuity of man is wonderful, so is the perverseness of his ingenuity. By nothing is this assertion more distinctly illustrated than by the various modes and instruments of torture which man has devised for his fellow. In "the good old times," as those who know little of history call any and all times save their own, torture was commonly practised in this country, though it was never sanctioned by law, but was, on the contrary, strictly illegal. When Felton, the murderer of the Duke of Buckingham, was brought before the Privy Council, it was proposed to question him upon the rack, to make him disclose his accomplices; but the question having been first referred to the judges for their opinion as to the right of the council to make such an order, the judges gave answer in November, 1628, that "he ought not by the law to be tortured by the rack, for no such punishment is known or allowed by our law." Nevertheless, there were in the Tower of London, and elsewhere, various instruments of torture, which had been much used under the Tudor princes, and also by James I. The use of them was introduced into England during the times of Henry VI., when there was no real government—certainly no one able, if willing, to interfere with those who chose to use tortures. In the old cruel time of feudal oppression, torture was a matter of every day occurrence, but not by authority of law. The Anglo-Saxon chronicle, speaking of what was done in the time of Stephen, says, "They took those whom they suspected to have any goods, by day and by night, seizing both men and women, and they put them in prison for their gold and silver, and tortured them with pains unspeakable, for never were any martyrs tormented as these were. They hung some up by their feet and smoked them with foul smoke; some by their thumbs, or by the head; and they hung burning things on their feet. They put a knotted string about their heads and twisted it till it went into the brain. They put them into dungeons, wherein were adders, and snakes, and toads, and thus wore them out. Some they put into a crucet-house—that is, into a chest that was short and narrow, and not deep—and they put sharp stones in it, and crushed the man therein, so that they broke all his limbs. There were hateful and grim things called sachenteges in many of the castles, and which two or three men had enough to do to carry. The sachentege was made thus: it was fastened to a beam, having a sharp iron to go round a man's throat and neck, so that he might noways sit, nor lie, nor sleep, but that he must bear all the iron. [A modification of this instrument is shown in the subjoined woodcut.] I cannot, and I may not tell of all the wounds and all the tortures that they inflicted upon the wretched men of this land."



INSTRUMENTS OF TORTURE. TEMP. HENRY VIII.

All this was done by private hands. The only legal cruelties allowed to be exercised on prisoners being the *peine forte et dure*—a process by which persons who refused to plead when arraigned, were stretched naked on their backs and pressed with huge stones and lumps of iron, being starved the while till they died or consented to plead—and the horrible operations of the hangman upon persons sentenced to death. The old sentence of death commanded that the prisoner should be taken back to prison, and be thence, on execution day, drawn upon a hurdle to the gallows, where he was to be hanged by the neck, but being alive, cut down, to be barbarously mutilated by the hangman, his head to be stricken off, and his body divided into four quarters, "the same to be at the disposal of the king." But although these were the only legalised tortures, the use of rack and screw, and such like abominations, became, as has been said, common in Tudor times.

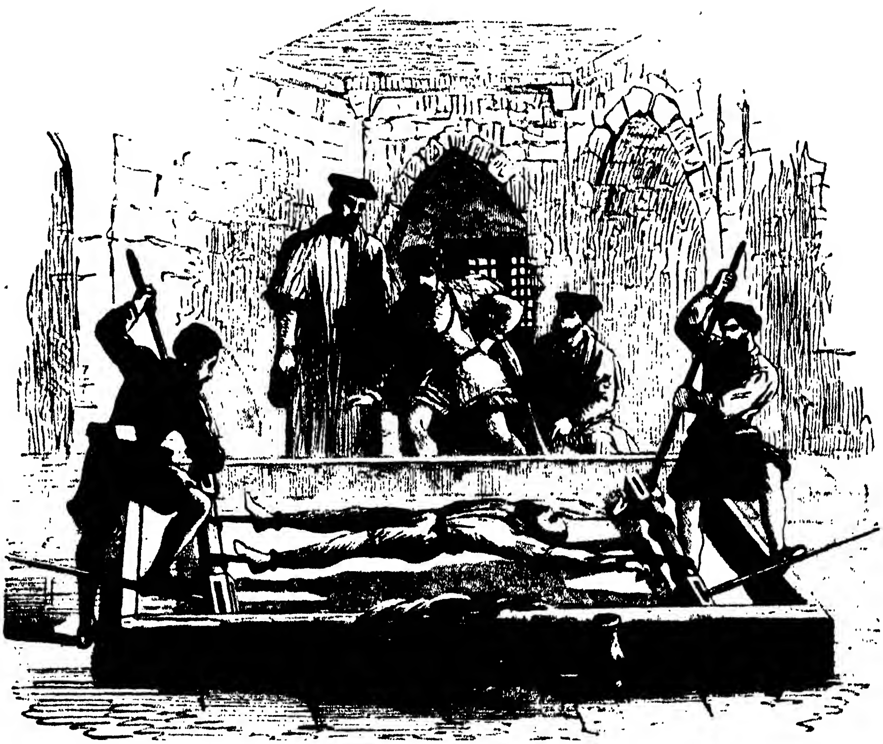
The rack was a large open frame of oak, raised three feet from the ground. The prisoner was laid under it, on his back, on the floor, his wrists and ankles were attached by cords to two rollers at the ends of the frames. These were moved by levers in opposite directions, till the body rose to a level with the frame. Questions were then put, and if the answers did not prove satisfactory, the sufferer was stretched more and more, till the bones started from their sockets. The Inquisition had a rack, which, in addition to the above, had an apparatus for torturing each toe. The suffering caused by this instrument was extreme, the prisoner after torture being often unable to stand up for several days; and it is said that in the case of Anne Ascue, the only woman known to have been racked in this country, the punishment was so severe as almost to tear her body asunder. The accompanying illustration shows a prisoner undergoing the torture of the rack.

Nicholas Owen, accused of participation in the Gunpowder Plot, was suspended by his thumbs from a beam, and questioned in that position. Threats of the rack in addition caused the poor wretch to commit suicide with his dinner-knife.

Skevington, lieutenant of the Tower under Henry VIII., invented a torture called Skevington's—corrupted into the Scavenger's—Daughter. The instrument consisted of a broad hoop of iron in two parts, but fastened together by a hinge. The prisoner was made to kneel, and the executioner putting his knees on the man's shoulders, passed the hoop under his legs, compressing the victim till he was able to make the extremities of the hoop fasten over the back. An hour and a half was the time prescribed for this torture. During that time blood often started from the nose and ears, and even, it is said, from the hands and feet. The small illustration on the preceding page shows some instruments of torture which are said to have been used in the time of Henry VIII., and are still preserved in the Tower.

Thumb-screws, causing exquisite torture to the hands, were also used; and in Scotland there was an iron boot into which the prisoner's leg was thrust, and wedges were driven in with hammers between the leg and the boot, causing frightful pain.

"Gauntlets" were used in England, having been imported from Spain. These were of iron, and so constructed that by aid of a screw the whole hand was compressed, and the wrists could be wrenched. There was also an arrangement by which a prisoner could be hung up by them to a beam. The prisoner was made to stand on three blocks of wood which, when his hands had been secured, were withdrawn, and the miserable man was left swinging in extreme pain. One man was thus tortured for five hours, during which time he fainted eight times, the executioners putting him again to the torture each time he recovered from his swoon. He says he felt as if all the blood in his body had run into his arms, and was bursting his fingers. His arms swelled so that the gauntlets were buried in his flesh.



THE TORTURE OF THE RACK.

Such were the means used to get confessions out of prisoners in England. Continental people, notably the Germans, Swiss, and Spaniards, had tortures, to which those used here were as nothing, and the Inquisition is credited with having owned instruments which nothing short of diabolical ingenuity could have invented. A large collection of instruments of torture of different kinds was found on board of many of the vessels of the Spanish Armada, which fell into the hands of the English.

BURNING LENSES AND MIRRORS.

THERE are few things in nature we enjoy more than sunshine, and yet just because we may possess it every day, and it costs us nothing, there are probably few things we appreciate less. But sometimes his beams fall rather too hotly upon us, and then we think of them, and yet how small an idea do the generality of persons form of the vast heat there is stored up in the sun's rays. If a person moves about in the sunshine, he is conscious of an equal amount of heat wherever he goes. He does not, however, carry the heat he feels about with him; neither does the heat follow him. It is fresh heat which he feels emanating from fresh rays. Two people of equal size receive between them twice the heat that one does; and if we could throw upon either person the heat received by the other, he would feel double as hot, of course.

If the direct rays of the sun fall upon the bulb of a thermometer, they will readily raise its temperature 40°. Suppose a thermometer to stand at 50° Fahr. in the shade, and the heat of the sun to raise it to 90½°; then twice the heat will raise it to 131°, and four times to 212°, which is just the heat of boiling water. But there is scarcely a limit to the extent to which it is possible to concentrate the sun's rays and heat. There are two ways of doing this: by reflection from a polished concave mirror, and by refraction through a convex lens.

The difficulty of constructing a concave mirror of large size, has been to some extent met by employing a great number of small pieces of flat looking-glass, and arranging them upon a frame in such a manner as that the rays of light reflected from the surface of each should fall upon the same spot. The amount of heat centred upon that spot is equal to the amount reflected by each multiplied by the number of pieces.

There are, however, reasons why less heat is concentrated by this means than by a uniform convex parabolic surface. In the latter case the point of concentration, or the "focus," is more minute, and the effect proportionately more intense. A Frenchman, named Villette, made some large burning-mirrors some years since. A metallic one which he constructed, nearly four feet in diameter, melted cast iron in sixteen seconds. But the reflection from silvered glass is better, and the heat more intense than from a metallic surface. A small one only twenty-two inches in diameter fused powdered flint into glass in less than half a minute.

Convex lenses of glass are capable of concentrating the sun's rays, and the effect of these when large is truly astonishing. Many years ago an English optician, named Parker, constructed a lens three feet in diameter, and its powers were such that a small cube of cast iron was melted in three seconds; even granite was fused in one minute.

We may, from these facts, be able to form some idea of the heat of the sun as a whole. Taking, for instance, Parker's lens as a foundation for the calculation, we arrive, by a simple rule of three sum, at the following:—If cast iron melts in three seconds under a concentration of seven square feet of sunshine, it will melt in less than the millionth of a second under the focus of a single square mile. Now the earth is constantly receiving as much sunshine as would illuminate 50,000,000 square miles of a flat surface, and even this vast quantity is as nothing, for, of course, our earth only receives that which happens to fall upon it, and if there were 2,380,000,000 worlds placed side by side, they would form the shell of a sphere round the sun, and each one would receive the same sunshine as we enjoy.

Curiosities of Water.

COLOUR OF RIVERS.—The Rhine, in its course from the Alps to the Lake of Constance, is *bluish;* after its passing through the green waters of that lake it is *grass-green*, and, after repeated mixture with the rivers and streams of Alsace and the Black Forest, *yellowish-green.* The Maine, flowing from the ferruginous rocks and plains of Franconia, acquires a *reddish-yellow* colour; during great degrees of cold it becomes *greenish-blue*, owing to the deposition of iron ochre; and, if it is not coloured yellow by long-continued rains, it flows onward with an *amber-grey* colour. All the rivers of Old Bavaria, which are formed of waters from lakes and Alpine streams on the Iller, Iser, and the Inn, are *bluish green* in winter, in spring *grass-green*, and in autumn pale *herb-green*.

DIVERSITY OF COLOUR IN THE SEA.—The waters of the sea, in different places and at different times, present almost every hue of the rainbow. Apart from the influence of the condition of the atmosphere on the light reflected by the ocean, there are seas which always present one shade of unusual colour. Thus there are the Yellow Sea of China, the Vermilion Sea of California, the Red Sea, the Black Sea, &c. The hue of the last-named is attributed to the frequent storms which agitate its surface, and the quantity of earthy matter brought into its bosom by the Danube and other rivers. But the tinge of the Red and other coloured seas is due to the presence of myriads of animalcules, while to the same cause is ascribed the "white water" of the Pacific Ocean, which extends between twenty and thirty miles, about lat. 8 deg. 46 min. S., and long. 105 deg. 30 min. E. The brilliant phosphorescence of the sea has also its source in minute organic life. Admiral Smyth remarks, as an instance of the variation of colour in adjacent waters, that the usual tint of the Mediterranean, when undisturbed by accidental or local causes, is a

bright and deep blue; but in the Adriatic a green tinge is prevalent, and in the Levant basin it borders on purple. Seamen generally admit one conclusion with regard to colour—that a green hue is a general indication of soundings, and indigo-blue a token of profound depth.

COLOSSAL STATUE OF BAVARIA.

THIS great work of Bavarian art at Munich, "awful in its Titanic proportions and calm majestic beauty," aims at embodying a grand idea of nationality, suggested by King Ludwig, who will long be remembered for the grandeur which characterises all his ideas of commemorating his kingdom's honour.

The "Bavaria" was, at the king's suggestion, designed by Schwanthaler, the sculptor, and his friend Lazarini, who modelled the colossal figure under his direction. For the casting it was necessary to melt twenty tons of bronze, five tons more than had ever been melted in the furnace, a most perilous labour. To give some tangible idea of the size of the figure, in the head and the upper part of the bust five-and-twenty men have found room; in the central part of the figure thirty-five or forty persons could dine, and the space of ground covered by the lower section is enormous in proportion.

The figure of this colossal maiden, with her majestic li a by her side, is fifty-four feet high, and is placed on a granite pedestal thirty feet in height, so that the beautiful marble temple of the *Ruhmeshalle*, or Hall of Fame, erected behind, seems dwarfed into insignificance. The hill, on the summit of which the statue is placed, is thirty feet high, hence, from the level of the plain on which it rises, the whole elevation attained by the statue is 114 feet.

The figure itself is nearly twice the height of the equestrian statue of the Duke of Wellington, opposite Hyde Park Corner.

Through the interior of this bronze tower-like figure of the Bavaria ascends a winding staircase, leading to a chamber in the head, large enough to contain twenty-eight persons; whence, through the openings among the curls, the spectator can look across the plain and city of Munich towards the glorious Alps. It required ten years of stupendous toil, mental and bodily, difficulties overcome by patient industry, and dangers endured with unflinching courage, to complete this gigantic work.

The statue was uncovered and inaugurated on the 3rd of October, 1850, with festivities and artistic processions, in the presence of King Ludwig, accompanied by his queen and King Otho, and vast multitudes of people, and amidst vocal and instrumental music. The unveiling was an impressive scene. A rope was loosened by a small human figure, far up aloft; the screen fell with a loud sound, which the roar of cannon repeated, and the shout of the multitude prolonged, and the mighty Bavaria stood revealed, awful and beautiful, of a pale, tawny, gold colour—the sunlight catching on her sublime brow, on her rounded shoulder, on her strong, large arm, which pressed to her side a laurel-wreathed sword. It caught on the sword-hilt, and burned and glittered like a star. Then fell the lower screens, and bands of singers, with banners displayed, swarmed on either side of the pedestal, and broke forth into one mighty song of triumph. In the presence of that marvellous colossal virgin, their voices sounded strangely small and human.

In the singular softness and benignity which characterises the expression of the gigantic face, Schwanthaler has admirably carried out the idea of his royal patron. The whole character of the figure is exquisitely feminine, yet there is, at the same time, a majesty, especially in the countenance, never equalled in any work of modern sculpture. The attitude is that of encouragement. The wreath is formed of oak-leaves and fruits, the oak being the national tree of Bavaria, as it is of England. The crown, composed of loosened fetters, is emblematic of the worthily-earned independence of Bavarian citizens, and has reference to the love of freedom which characterised the Bavarians in the middle ages. The right hand rests on a sword, sheathed and placed in the girdle of the figure, which is intended to be emblematic of peace; and the wild, almost savage, costume recalls the condition of the German people in the earliest ages of which we have record. The back of the figure is at least as beautiful as the front, and the magnificent tresses, which are so exquisitely modelled that the metal of which they are composed seems almost to wave in natural curls, represents the long hair so characteristic of the Germans in all ages.

PARASITES.

ONE of the most wonderful results of the study of natural history, is the proof that nearly every living thing is preyed upon by others smaller than itself. There are minute creatures, and some of considerable size, that either live within the bodies of others, or attach themselves to the outside. In either instance, the parasites, as they are termed, nourish themselves at the expense of the creature to which they are attached, by devouring in some way or other the circulating and other fluids like the blood. Even the parasites are themselves often preyed upon by others; and there are usually different parasites in different kinds of animals. Some parasites exist in the midst of the bodies of the larger animals, and their method of getting there and of producing young, which some time or other have to enter other creatures, is very curious. So greatly are

fish infested by the parasites, that it is probably true that there are more kinds of them than of the fishes. Even the reptiles are troubled, like birds, with the minute beings that live at their expense; and the domestic animals are especially liable to serious diseases from parasites. Man, although the noblest thing created, has a terrible number of disagreeable creatures parasitic upon or within him, and it is a matter of common observation that weak health is produced by parasitic worms, and even death by some that get into the liver, kidneys, and muscles. The parasite of one animal or insect when swallowed by another animal, changes its form and method of life in such an extraordinary manner, that it looks like a different creature altogether, and when many parasites which affect fish are floating about in the water, they are not in the least like what they turn to when they once get within their prey. The common mouse and house-rat often die from the effects of a parasite which gets into the liver. It is very much like a small bladder with a long head, on which are some hooks, and it swells out and grows by absorbing the juices of the liver. After awhile it increases so much in size, that the mice and rats fall away and die. If one of them is eaten by a cat, it is revenged by introducing its parasite into the stomach of its great enemy.

The cat does not, however, suffer from the parasite's getting into its liver, for it undergoes a change of form, and turns into a long flat tape-worm. The tape-worm thus descended from the liver-parasite, lives in the intestines of the cat, and nourishes itself at the expense of the milk and meat of that household pet. There is a small red snail in Germany which lives in damp places, and a tiny animalcule that floats about in standing water often sticks to it. The animalcule has a round body and a flat top, on which is a circlet of hook-like arms. Sooner or later, the animalcule gets into the breathing organ of the snail, attaches itself to the tissues by means of its hooks, and lives a lazy do-nothing life, drinking in the juices of the snail's body. Many birds and some small animals prey upon these snails, and especially a magpie and a shrew. Now, when swallowed by one of these, the animalcule passes into the intestines, and sticks on to the side by its hooks; moreover, it grows, and finally has a long tail made up of square flat joints, and it thus becomes a tape-worm. Each flat joint produces myriads of eggs, which when dropped into water, turn to the little animalcules infecting the snails. Pigs are such careless feeders that they enjoy almost everything, and the consequence is, they often eat substances which contain the eggs of parasites. The Israelites were commanded not to eat pork, and this law is obeyed by most Asiatic nations, and the wisdom of the command is manifest. Most probably one of the parasites which lives in the pig, turns to the tape-worm when it is eaten by man; and the small worm called trichinia, which exists in the hog tribe, when introduced into the human body, generally produces death. In order to destroy the parasites and their eggs, a heat very little short of the boiling-point is required, and consequently, if pork which contains them is badly cooked, the living pests are introduced into the stomach. The Germans frequently eat ham which is smoked and dried, but which has never been exposed to a high temperature, and occasionally we read of the death of half-a-dozen people in one village, from the gradual decay of the muscular strength, and of simple weakness. On examining the muscles of these unfortunate people with a microscope, millions of very small transparent sacs are found in them, and each sac contains a trichinia curled up in it. The parasites destroy the muscles, and increase at the expense of the fluids of the body; hence the falling away and subsequent exhaustion. Many parasites are introduced into the blood-vessels in the form of eggs, and they wander about the veins and arteries for some time: when the young creature attains a certain size, the egg bursts, and it settles down in a small blood-vessel, and either eats its way into the surrounding structures, or swells up and stops where it was. One rare human parasite introduced in this manner, has been found in the form of a small worm, which lives in the eye; and it is very remarkable that the horse should be troubled with a parasite of a similar shape, which blinds it very frequently.

The famous Guinea-worm is an inhabitant of the tropical regions of Asia and Africa: it exists in ponds, rivers, and swamps, and penetrates the skin of the feet and legs, and even the eye-lids, without being felt. It soon grows and becomes a small round worm as thick as a small fiddle-string, and it is situated just under the skin. Its length varies from six inches to twelve feet, and it lives by absorbing the nutritive part of the blood which ought to go to the skin. Should the Guinea-worm grow to a great size, there is danger of mortification, for it is sure to burst eventually, and then great inflammation of the parts of the body all around commences. There is, therefore, great care required in extracting the Guinea-worm, for it is very fragile and delicate. A small opening is made in the skin, and the end of the creature is pulled out and curled round a small piece of wood; on the next day the wood is twisted so as to draw out some more of the worm, and if this operation is carefully performed, day after day, the parasite may be extracted without danger. It is very wonderful that the kinds of parasites should be so numerous, and that certain of them should select certain creatures for their habitation, and that the same pest should always choose the same structure to live in.

BORING INSECTS.

Many of the lower forms of animal life possess powers of boring which, considering the soft materials of which they are made, seem very surprising. It is hard for us to understand how such animals are naturally provided with tools adequate in some cases for penetrating into the densest timber, or in others even into the solid rock.

We find no difficulty in understanding how shell-fish can bury themselves in the sand—the common cockle is an excellent burrower in this yielding material. The razor-shell dwells in a long tube in the sand which he has formed by his own labours, from which he can only be extracted by darting down it a long barbed rod. This penetrates his shell and he is withdrawn; but if this be not done with great rapidity he is enabled to escape, as he can move very quickly in his hole. There is another shell belonging to the same tribe as the razor-shell, which excavates for itself a hole in the solid rock. This animal has no English name; its Latin one is Pholas. It is to be met with in limestone rocks on the sea coast, into which it bores holes to a depth of several inches.

It is still a disputed point among naturalists as to how this boring is effected. Some think that the animal is enabled to secrete some acid which softens or dissolves the limestone, while others think that it is by the mechanical process of grinding that it is accomplished. The preponderance of opinion seems to lie now with the latter view. Another boring shell is the well-known ship-worm or teredo. This burrows into wood to a great depth, and many an otherwise good ship has been rendered unseaworthy by the attacks of this indefatigable borer. Of course a metallic coating to the vessel is a complete preservative against their attacks.

THE RAVAGES OF THE WOOD-BORING BEETLE.

Our illustration represents a borer of a very different kind. The animal that accomplishes these excavations in the trunk of a tree is not a shell-fish, but an insect. The parent, when about to deposit her eggs, selects a tree of suitable size, and commences her operations on the bark. At

the bottom of the illustration will be observed a small inclined hole, and at the end of this a beetle is to be seen; this is the little architect who, by the joint exertions of herself and her progeny, has so wonderfully penetrated the tree in every direction. Another hole, running horizontally across, will likewise be seen at the right of the figure, and in the end of this another beetle may be seen similarly engaged. When the exertions of the insect have prepared a sufficiently large hole she then commences to lay her eggs: but before proceeding to this subject, let us just dwell for a moment upon the magnitude of the work she has accomplished.

The hole bored into the heart of solid wood is about fourteen or fifteen times longer than the body of the beetle, and the animal must, by the help of its jaws, tear away and remove a bulk of timber more than twenty times its own bulk. We shall gain some idea of the amount of labour necessary for this, by considering what would be the corresponding work that should be executed by a man, were he to be equally adapted with the beetle for this kind of work. He would have in a few days to bore into a mass of solid timber a cylindrical hole, about eighty or ninety feet long, and about three feet in diameter.

The central part of the illustration shows another stage in the history of these tunnelling operations. We will suppose that a beetle has finished the hole of which the two already described are the commencements. All along each of these will be seen little white spots; these represent the eggs which she lays as she proceeds. The long line in the centre of the figure represents a part of the completed hole, along the sides of which the eggs are laid.

When the eggs of the beetle are hatched, the little animal that comes from them is at that stage of its existence utterly unlike its parents. It is at first a little grub without legs, and quite as unlike a beetle as an earth-worm is unlike a house-fly; this is called the larva condition of the beetle; and it is equally true of every other insect, that in the early stages of its existence it is utterly unlike in appearance, in food, and habits, to the parents from whom it has sprung. Thus the dragon-fly, with which we are all so familiar, and which is such an ornament to our streams, was, when young, an unattractive and somewhat ferocious-looking grub, wholly resident in the water, over which, when mature, it skims, but which it never touches. The food, too, of the larva of the dragon-fly is quite different from that of the mature insect.

This being understood, we shall not be surprised to find that when the eggs of the beetle we are describing are hatched, the young that come from them are quite unlike their parents. They are small white grubs, rather uninteresting in appearance, but endowed with a most tremendous appetite and vast powers of digestion. The food which supports the little grub is the solid wood of the tree itself. It will be remembered that each egg was deposited on the side of the hole, and there it remains attached until it is hatched; thus the little creature finds, the moment it becomes conscious of its existence, the food which nature intended for it surrounding it in boundless profusion. At once it commences to eat the wood that is under it, and thus it speedily excavates for itself a little hole, the bottom of which gradually deepens as the insect proceeds. Its brothers and sisters, likewise hatched about the same time, commence each to eat their small hole, and thus from the main tunnel a number of small holes gradually extend through the trunk, all commencing, of course, from the hole originally made by the parent insect.

Now, as the little grubs progress onwards they, at the same time, grow in size, and their appetite consequently increasing, the hole gets gradually larger, and this is, of course, also necessary to allow for their increased dimensions. Gradually they proceed farther and farther from the centre, and approach nearer and nearer to the outside of the tree; but just before they finally emerge, when they are just beneath the bark, a curious change comes over them. They have now grown to be as large as their parent, but still they are grubs; they have not donned the legs and wings which are necessary for the perfect beetle, but the tree which has housed and fed them in their infancy still affords them shelter till their final development. As they get near the bark they cease to eat, and fall into an inert condition; but all this time a wonderful change is taking place within their bodies—they cast off their skin and are transformed into perfect beetles. Speedily they emerge from the tree to find themselves in a new and wondrous world, and to use and enjoy those powers of flight which they have so recently and so curiously acquired. Truly this is a very astonishing history; we have seen one beetle boring into a tree, we see a hundred emerge from it: the solid substance of the trunk has afforded nourishment to the numerous offspring. There is no more interesting department of natural history than that which treats of the habitations of insects; and there is, perhaps, hardly any insect more interesting in this respect than this wood-boring beetle.

THE GULF STREAM.

AMONG the wonders of physical geography, few are more interesting in their relation to this country than what is known as the Gulf Stream. This is an oceanic current of great extent, which takes its rise in the Gulf of Mexico, whence it derives its name. The peculiar formation and position of this

gulf render it a receptacle for the waters of the Atlantic, which sweep across the north-eastern coast of South America; and, on arriving in the Gulf, they become warmed to a much higher temperature than is anywhere found in the surrounding ocean. The summer temperature of the waters in the Gulf is about eighty-eight degrees, while in the Atlantic, in the same latitude, it is only seventy-eight degrees.

Thus warmed, the waters pass out of the Gulf northward, in a deep and strong current, through the coast of Florida on the one side, and the islands of Cuba and the Bahamas on the other. The stream progresses here with a velocity of five miles an hour. It rolls like a mighty river along the shore of North America, widening as it flows, until it nears the banks of Newfoundland, where it is turned aside, partly by the formation of the coast, which here projects boldly out, and partly by the encounter with strong and adverse currents from the North Atlantic. At the point where it is turned aside, it stretches almost across the Atlantic; the current itself, according to some, being about two hundred miles in width, and the warm waters of the stream extending in all more than twice that distance. In the latter part of its course it leaves behind it that remarkable drift of sea-weed known as the Mer de Sargasso, which has been described in a former paper.

Crossing the Atlantic eastward, towards the islands of the Azores, the main stream gradually becomes lost and its current spent; but a portion of it continues northward towards the British Islands. Long after the current itself is lost, the neighbouring seas continue very sensibly affected by the warm waters which it has brought down. It was stated by Commander Chimmo, at a recent meeting of the Royal Geographical Society, that in one hour's sailing into or out of the current of the Gulf Stream, the temperature changes no less than from twenty to twenty-five degrees; and that a ship may be so placed that her bow and her stern are floating in water the heat of which differs greatly.

It is important to bear in mind the distinction between the actual current of the Gulf Stream, and the heated waters which are brought down by its agency. The range of the latter extends some hundreds of miles after what is properly termed the Gulf current has ceased. The waters of the stream often bring cocoa-nuts and other tropical fruits to the shores of Europe, and some have at times been left in this manner upon our own coasts.

These warm waters, bathing our western coasts, mitigate the severity of our climate to a considerable degree. While places situated in the same latitudes, both to the east and to the west, are frozen and comparatively uninhabitable during a large portion of the year, our islands, as a rule, enjoy a climate; and this fact is attributed in a great measure to the beneficent influence of the warm waters brought down by the Gulf Stream. The peculiar verdure of the "Emerald Isle," and the mildness of our own seasons when Labrador and the regions round the Baltic are locked in ice, are thus believed to be the effects of an oceanic current which sets out more than four thousand miles away.

The waters of the Gulf Stream are distinctly traced by their colour, which is of a deep blue, contrasting strongly with the green of the seas with which it eventually mingles. The difference of temperature between the waters of the stream and those of the Northern Ocean, leads to the melting away of icebergs brought down from the Arctic Regions on the breaking up of the winter season.

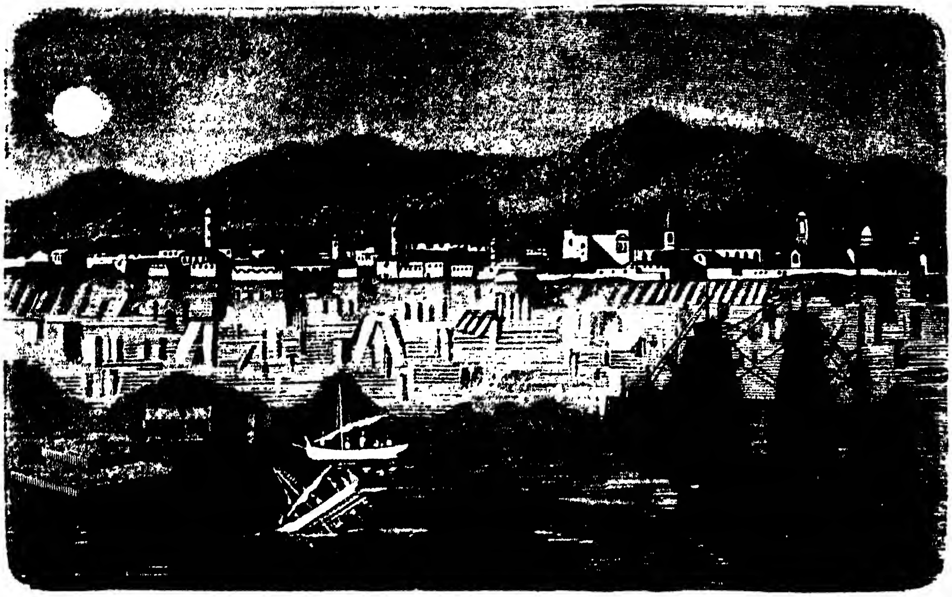
The temperature of this stream, being so much higher than that of the surrounding seas, exercises an important influence on the atmosphere above. It carries with it a warm, moist air, which, coming into collision with that of colder regions, produces strong winds and frequently violent tempests. The neighbourhood of the Gulf Stream is well known to sailors as peculiarly the region of storms; and in their passage across the ocean they avoid it as much as possible for this reason. Whenever, from any cause, the current is of greater volume and force than usual, these storms are proportionately increased.

This leads us to notice a plausible theory which was started to account for the particularly mild winter experienced in 1868-9, in combination with a series of violent gales. The frequent occurrence of earthquakes in the southern seas, recorded a few months before, gave rise, it was asserted, to a more than ordinary influx of waters from those seas towards the Mexican Gulf. The volume of the Gulf Stream was consequently largely increased, and its effects were therefore felt more powerfully than usual upon our shores, both in the mildness of the season and the frequency of storms. We record this as a remarkable theory, put forward with confidence in some quarters; but it is only fair to say that it has been questioned by many of our scientific men.

Wonders of the Atmosphere.

SPECTRES OF THE AIR.

THE two plates which illustrate our paper represent the three ways in which strange spectral appearances may be represented in the air. No organ of sense is so liable to deception as the eye: it is only capable of being affected by light; and anything which can divert the path of the light, or in any way alter the ray in its passage from the object to the eye, is the means of causing that organ to receive a false perception of the object it fancies it sees.



THE FATA MORGANA.

How admirably this deception was practised in the instance of Pepper's ghost! The mode in which that spectral personage is produced we have already described; and if we had an unlimited supply of plate-glass, and an unlimited power of fixing it in any position in the air, we could produce most wonderful spectral illusions—spectral landscapes on a gigantic scale.

Occasionally Nature, in those freaks by which she pleasingly diversifies the ordinary course of affairs, furnishes us with these very spectral appearances; and the mode by which this is accomplished is not difficult to understand.

On page 52 an account is given of the Spectre of the Brocken, and the admirable illustration of that phenomenon at once shows that the rays of the setting sun—slanting up, as it were, from a point lower than the summit of the mountain—cast the shadows of the figures upon the banks of clouds, the shadows increasing in size with the distance of the clouds. This is very simple, and the appearance might be presented in any part of the world, providing a figure be placed between the sun and a screen of clouds—just as a candle will throw the shadow of an object on the wall.

The other spectral illusions are, perhaps, not so evident, yet they may be readily understood. Eastern travellers often tell scarcely credible tales of the mirage of the desert. Suddenly in the distance, where all is known to be arid sand, appears a sheet of water. Here and there upon its bosom lie enchanted islands, above the top of whose woody groves rise the turrets of castles, or minarets of mosques. So real is the sight, that men and camels push forward, longing to bathe in the refreshing waters of this fairy lake; but as they advance, the mirage retreats, and all fades as the sun sinks beneath the lurid horizon. The explanation of the phenomenon is this: that the sand, being intensely hot, causes the layer of air which rests upon it to become greatly rarefied; and under certain circumstances this layer is quite distinct from the denser stratum a few inches or feet above it—just as if it were a sheet of water upon which oil rested, the surface at which the two layers meet being quite sharply defined.

In Egypt, where the mirage is chiefly witnessed, the villages are built upon eminences which rise from the plain. The houses are reflected from the surface of the two layers of air, just as if that surface were a sheet of plate-glass stretched over the plain; and thus the reflection of the trees and houses, multiplied by the slight unevennesses and undulations of the atmospheric reflector, give them a grander and more fantastic appearance than a true reflection. The light from the sky is reflected on other parts of the plain, producing the effect of a sheet of water. In many parts of the world the mirage is produced; indeed, wherever there is a wide surface of hot sand, by which the air, resting upon it, can be divided into layers of different densities, the conditions for the appearance of the mirage are fulfilled.

This explanation will, in some measure, account for that illusion which is occasionally seen on the Straits of Messina. The Italians called it the

SPECTRAL SHIPS.

Fata Morgana. It is thus described by Angellicci, who was fortunate enough to witness it:—"As I stood at my window, I was surprised with a most wonderful delectable vision. The sea that washes the Sicilian shore swelled up for the distance of ten miles, like a chain of dark mountains; while the waters near the Calabrian shore grew quite smooth, and in an instant, appeared as one clear polished mirror, reclining against the aforesaid ridge. On this glass was depicted, in *chiaroscuro*, a string of several thousands of pilasters, all equal in altitude, distance, and degree of light and shade. In a moment they lost half their height, and bent into arcades like Roman aqueducts. A long cornice was next formed on the top, and above it rose castles innumerable, all perfectly alike. These soon split into towers, which were shortly after lost in colonnades, and, at last, ended in pines, cypresses, and other trees, even and similar. This was the Fata Morgana, which for twenty-six years I had thought a mere fable."

Our illustration gives an idea of the general effect. The reflection of the houses on the opposite coast is not from the water, but from the surface of a layer of air of a different density from the one resting upon it. The fantastic appearances of rows of colonnades, and the lines of pilasters, is caused somewhat after the fashion of the images in a kaleidoscope—by numerous reflections of the same object.

To produce the Fata Morgana, the observer must be above the level of the reflecting surface; but when a stratum of denser air is situated above the eye, as is sometimes the case at sea, then a phenomenon such as the reflection of the steamer in our second illustration is caused. The reader will readily conceive the philosophy of this, if a plate of glass be imagined to exist parallel to the surface of the sea at the height of the reflected ship. Thus we should see the vessel upside down, and the stratum of denser air has precisely the same effect.

The double reflection of the three-masted ship is somewhat more complicated. The vessel itself is almost below the horizon, and, indeed, the reflection in the sky of a ship thirty or forty miles distant has been seen.

The inverted reflection is due to the same cause as that of the steamer. In each of these cases, as in all cases of reflection, only some of the rays of light were reflected or thrown back from the surface—the rest passing into the upper stratum; and if we could have risen in a balloon, in all probability we should have been able to reach these rays, and thus have seen the other image of the steamer upright, and keel to keel with the inverted image. In the case of this ship, the reflecting surface happens to be in the right position for the observer not only to catch the first reflection, but the rays which entered the upper layer are refracted, or bent down to the eye, and thus the second image becomes visible. Two simple and interesting experiments, illustrative of the refractive powers of water and air, are given under the article on the "Spectre of the Brocken," to which the reader is referred.

THE PNEUMATIC DESPATCH.

THE possibility of utilising compressed air for the production of motion is not a novelty; indeed it is evident that whenever anything elastic is forcibly retained in a condition or position different to its natural state, it will exert an amount of force in its endeavours to return to its natural condition, exactly proportionate to that applied to restrain it. Air is no exception to the rule. If it be compressed, it will endeavour to expand; and the more it is compressed, the more forcibly it seeks to expand. The air-gun is a familiar instance of power exerted by compressed air.

Air in a high state of compression is necessary in order to produce much effect, when the surface acted upon is small, as in the air-gun; but if the surface is large, a very decided action is produced by the mere force of air moving against it at a high velocity. This is evident from the well-known effects of high winds, which are sufficient to blow down houses and uproot trees.

It is then with air at a high velocity, rather than at a high pressure, that we have to deal in connection with the Pneumatic Despatch; but when air impinges at a high velocity upon an unyielding surface, it does undoubtedly exercise a certain amount of pressure upon it. For instance, wind travelling at the rate of one hundred miles an hour, which would be called a destructive hurricane, exerts a pressure of forty pounds upon every square foot of surface, but as there are one hundred and forty-four square inches in this extent, wind of even this violence presses upon each square inch with a force of barely four and a half ounces.

The idea of utilising air under any degree of pressure in long tubes, occurred first in connection with telegraphy, messages being enclosed in a thimble of leather, and projected through a tube placed under the streets. The Pneumatic Telegraph paved the way for higher results. It was evident that no great pressure would be needed to propel a larger body than the "thimble" through a larger tube, and that the friction against the sides might be reduced by inserting wheels upon the outside. A tube of cast-iron was accordingly made, not cylindrical, but shaped very much like the Thames Tunnel, the height and breadth being about thirty inches. This was laid down experimentally, neither level nor straight, so that the capabilities of the system in going round curves, and in ascending inclines, might be demonstrated. The carriages were constructed of thin sheet-iron, and rested upon four wheels, the ends of the carriages very nearly fitting the tube; whilst a thick band of vulcanised rubber, outside the frame, served the double purpose of making them more nearly fit the tube, and of preventing a jar if they chanced to jerk against the side.

The current of air was obtained in the following way:—Two very large circular plates of iron were built up, not perfectly flat, but bulging outwards towards the middle. They were fixed at a few inches apart, by flat pieces of iron extending from near the centre to the circumference, placed at equal distances, and which thus divided the space between them into sectors. The whole fabric formed a kind of hollow wheel with solid sides, it was fixed to a hollow shaft, and rested on hollow bearings, upon which it rotated. When caused to revolve, the air confined in the hollow sectors was driven round with the wheel, and by centrifugal force thrown outwards; fresh air then passed up through the bearings into the axle and thence into the wheel to supply the place of that ejected, and so long as the wheel revolved a continued stream of air passed from the bearings outwards from the wheel—the greater the speed of rotation, the greater being the rush of air. If now a communication was effected between the bearings and the tube, the supply of air being drawn from it, a carriage in any part of it would be pulled along by the great draught.

To return to the wheel: a large case of sheet-iron plates, riveted together, entirely enclosed it; there was but one outlet, and this, by the action of a valve, could be made to communicate with the tube. When the wheel rotated, the air ejected from it was thrown into the case, and the case-valve being opened, this air was blown into the tube, and any carriage placed inside it would be propelled. This, then, is the principle of the Pneumatic Despatch, propulsion or traction being obtained at will, by opening either the case-valve or the bearing-valve.

The mechanical details and contrivances connected with the system were highly ingenious. Speaking of them generally, there was a close-fitting door at each end of the tube, kept shut by a stud, but which, when the stud was withdrawn opened quickly by either a spring or a weight. The stud was connected by means of an iron rod with a treadle resting over the rail, and placed a few yards inside the tube; the pressure upon it, caused by the passage of the carriage, released the stud and allowed the doors to fly open.

The reason the doors were kept closed until just before the arrival of the carriage, was that the air enclosed between it and the doors might act as a buffer to check the speed of the carriage. A few yards further from the end than the treadle, was a large orifice in the tube, through which the air in front of the moving carriage freely escaped; but directly this was passed, no means of egress for the air existed whilst the door was shut, except through a valve, by the adjustment of which the arrival speed of the carriage could be so accurately regulated, that it would stop within a yard of the same spot outside the tube.

Curiosities of Esquimaux Life.

SNOW-HOUSES OF THE ESQUIMAUX.—In the winter season the Esquimaux live in huts built of snow, and we may imagine what must have been the necessity and distress that could first have suggested to a human being the idea of using such an unpromising material as a means of protecting himself from cold. Be that as it may, the snow "igloe," or hut, affords not only security from the inclemency of the weather, but more comfort than either stone or wooden buildings without fire. The construction of them requires considerable tact, and is always performed by the men, two being required for it, one outside and the other inside. Blocks of snow are first cut out with some sharp instrument from the spot that is intended to form the floor of the dwelling, and raised on edge, inclining a little inward around the cavity. These blocks are generally about two feet in length, two in breadth, and eight inches thick, and are joined close together. In this manner the edifice is erected, contracting at each successive tier, until there only remains a small aperture at the top, which is filled by a slab of clear ice, that serves both as a keystone to the arch and a window to light the dwelling. An embankment of snow is raised around the wall, and covered with skins, which answer the double purpose of beds and seats. The inside of the hut presents the figure of an arch or dome; the usual dimensions are ten or twelve feet in diameter, and about eight feet in height at the centre. Sometimes two or three families congregate under the same roof, having separate apartments communicating with the main building, that are used as bedrooms. The entrance to the "igloe" is effected through a winding covered passage, which stands open by day, but is closed up at night by placing slabs of ice at the angle of each bend, and thus the inmates are perfectly secured against the severest cold.—*M'Lean's "Hudson's Bay Territory."*

EATING POWERS OF THE ESQUIMAUX.—Dr. Letheby, in a paper on the "Economy of Food," states that Sir W. E. Parry once tried how much food an Esquimaux lad, scarcely full-grown, could consume in twenty-four hours. It was as follows:—4 lb. 4 oz. frozen sea-horse flesh, raw; 4 lb. 4 oz. frozen sea-horse flesh, boiled; 1 lb. 12 oz. bread and bread-dust; 1¼ pint rich gravy soup; 1 tumbler of strong grog; 3 wine-glasses of raw spirits; 9 pints of water.

WATCH FOUND IN A SHARK.

ON December 1, 1787, some fishermen fishing in the river Thames, near Poplar, with much difficulty drew into their boat a shark yet alive, but apparently very sickly. It was taken on shore, and, being opened, in its belly were found a silver watch, a metal chain, and a cornelian seal, together with several pieces of gold lace, supposed to have belonged to some young gentleman who was unfortunate enough to have fallen overboard, and to have been caught and swallowed by the shark. The body and other parts had either been digested or voided; but the watch and gold lace not being able to pass through it, the fish had become sickly, and would very soon have died.

The watch had the name of "Henry Watson, London. No. 1,369," and the works were very much impaired. On these circumstances being made public, Mr. Henry Watson, watchmaker, in Shoreditch, recollected that, about two years previously, he sold the watch to Mr. Ephraim Thompson, of Whitechapel, as a present to his son on his going out on his first voyage, on board the ship *Polly*, Captain Vane. When about three leagues off Falmouth, by a sudden heel of the vessel during a squall, young Thompson fell overboard, and was no more seen. The news of his being drowned soon after came to the knowledge of his friends, who little thought of hearing anything more concerning him.

This was the largest shark ever remembered to have been taken in the Thames, being from the tip of the nose to the extremity of the tail nine feet three inches; from the shoulder to the extremity of the body, six feet one inch; round the body, in the thickest part, six feet nine inches. The width of the jaws, when extended, was seventeen inches. It had five rows of teeth, and was consequently five years old, having an additional row every year till it arrives at full growth. These details have been, in the main, derived from the *Annual Register* of the time.

A WONDROUS DISORDER.

WITH all its extremely doubtful wonders related of possession and demonology, history has never recorded anything more strange than the visitation, hallucination, or mental disorder that, during the years 1857–64, prevailed amongst the inhabitants of Morzine, a village of the Haute Savoie, not many miles from that popular resort of tourists, the Lake of Geneva. So strange is the story in all its details, that at first one can hardly believe that it is a piece of contemporary history that we are reading. The visitation commenced with the strange seizure of a child of ten years, a little girl of an exceedingly enthusiastic religious temperament, and whose mind was said to be occupied by thoughts of religion continually, till one day when she sank down suddenly, and remained as one dead for some hours. A companion was soon after attacked in the same manner, and in a short time it became a common thing for these children to fall into a trance, on recovering from which they

would relate their experience—sometimes of happiness, at others of torment to which they had been subjected. Soon, however, the attacks grew more fierce: the children began to gesticulate, to talk incoherently, and even blaspheme and utter the most abominable oaths, their writhings and contortions at such times being so violent, that it took three strong men to restrain one child.

The disorder spread fast; a young girl gave out that she was possessed of seven devils; a boy in the convulsed state performed the most extraordinary acts—running up a large pine tree, about eighty feet high; and when there, apparently relieved from the influence, prayed in agonised tones to be helped down. The father of the first child attacked, as if fulfilling a prediction uttered by his daughter, withered away to a skeleton, declaring himself unable to eat, and at the end of three months died. At the end of eight months about thirty people were affected by this so-called demoniacal malady, one which resisted for a time the efforts of doctors and those who turned their attention to the complaint. People affected became convulsed, throwing themselves about in the most frightful way, being apparently quite insensible to pain; pins or needles thrust even beneath the finger-nails producing no effect; but, evidently under the impression that they were possessed of the devil, they raved and uttered maledictions on all who approached.

So wide-spread grew the evil, that at last the attention of the French government was drawn to the place; for the superstitious inhabitants, upon finding the aid of doctor and priest unavailing, resorted to exorcism; accused inimical people of having bewitched them; and even went so far as to attack the suspected, as well as those who tried to laugh them out of their fears. Naturally a quiet, religious, and enthusiastic people, those who were affected seemed to be turned into the vilest of the earth, uttering blasphemies that drove their religious teachers away in despair.

At length, in 1861, Dr. Constans, inspector-general of lunatics, arrived at Morzine, to find one hundred and twenty people of all ages suffering from this strange mania. The doctor, in his report, described the acts of the people as little short of marvellous; their feats in bounding, throwing themselves about, and writhing, was as if their bodies had been changed into a steel spring, while, in spite of falls and blows, their flesh appeared invulnerable, suffering neither bruise nor other injury. Some seemed to have the organs of sight and hearing quickened, so that to one is attributed the power of hearing the bells of a church ringing at the distance of thirty-five miles; the same woman, without any previous knowledge of the fact, declaring truthfully the purpose for which they rang.

During the stay of Dr. Constans, the complaint seemed to smoulder; but on his quitting Morzine, it burst forth with renewed fury. The ecclesiastics attributing it to demoniacal possession, tried again and again the effect of religious rites; the bishop of Annecy, a much-loved and venerated man, determining to try the effect of his presence, and the administration of the sacrament of confirmation in the valley. There was a very full attendance at the high mass he celebrated, but the moral effect was *nil*. The ceremony commenced at seven in the morning, but in five minutes a young girl fell down in horrible convulsions, striking head, hands, and feet upon the floor with the rapid beat of the roll of a drum. Then, one after the other, people were seized with similar fits, till the church rang with the most fearful oaths and blasphemies. The very entrance of the bishop seemed the signal for "blows, kicks, spitting, horrible convulsions, handfuls of hair and caps flung about;" while the most frightful moments were at the elevation of the host and the benediction. Quite a hundred people in the church were in horrible convulsions; and in spite of all this, the bishop kept on laying hands upon those who swore at, struck, and spat upon him. Evidently believing themselves the abode of some unclean spirit, young women spoke as did the possessed of old, in scriptural words, such as from long religious teaching were familiar to them, but becoming tranquil when some solemn adjuration was pronounced.

Completely dispirited, the good bishop left; and seeing the result, government once more sent their commissioner of lunacy, backed by the power of a dictator. He had a detachment of soldiery, and a brigade of gendarmes, and at once set to work to try and root out the evil. Those who accused others of witchcraft or magic were heavily fined; decrees and edicts were issued, and it soon became known that those who suffered were to be sent away from the valley, many even to lunatic asylums. The subject was even forbidden to be talked of; and whatever the disorder, mental or spiritual, bodily weakness, or imposition in the first case working upon the fears of the susceptible, the stringent acts of the commissioner had their effect, so that soon after his last coming the cases of convulsion died out, one fear counteracting another; the soldiery were withdrawn, and peace once more reigned in the valley.

Similar attacks are not unknown to the student of history: we may instance the demonopathy of the sixteenth century, and the Jansenist and Cevennes convulsionaries; but in these latter days of advance, such scenes as were presented during eight years, setting science at defiance for so long a period, and presenting such a combination of hallucinations, cannot well be recorded by any other term than that of wonderful.

TRAVELLING FISH.

Some fishes are endued with the faculty of living out of water—of being literally fishes out of water—with apparently the greatest ease. Some species bury themselves in the [illegible] of the ponds in which they have their local habitation, but which are apt, in the dry season, to become waterless. Others have been met going in troops from the dry bed of their late pond to some other pond in the neighbourhood. The most remarkable specimen of the kind, however, is the climbing perch, of which a portrait is annexed. This curious creature (*Anabas scandens*) has a peculiar formation of the upper part of its head, by which, in a number of cells, a supply of water is retained to moisten the gills of the fish when absent on its travels. Frequently it quits its wonted pond for a considerable ramble inland; and it has been found so remote from water as to induce the belief that it must have fallen from the skies in a shower. It has been said, but also denied, that the fish is in the habit of climbing trees, and that its name is traceable to that fact. One naturalist avers that he once captured a perch at a height of five feet from the ground, on the stem of a palm tree; and it is certain that the formation both of the mouth and the fins is such as to warrant the idea that the creature might so climb. How long he can live out of his element it is difficult to know, but the probability is for a short time only. The conjurers of India and China exhibit these and some other members of this family of *Anabasidæ*, of course attributing to their own magical influence the natural powers of the fish. The flesh is good to eat, and is not unlike turbot. The fish is so tenacious of life that fishermen are reported to bring it alive to market, and even to cut it up gradually, in order to suit the wants of small purchasers.

THE CLIMBING PERCH.

The travelling propensities of fish are exemplified to the fullest extent by the climbing perch; but that creature is by no means the only member of the finny tribe who is wont to take his walks abroad. Salmon are accustomed to make an entire change twice a year in their local habitation. In the spawning season, when they are in prime condition, they quit the sea, and, ascending the course of rivers, seek a place where they may in safety deposit their eggs In arriving at this place, which they fix, for reasons well known to themselves, at the very sources of rivers, they allow no barrier, no obstacle, to stand in their way unconquered. Weirs, cataracts, and falls, over fifteen feet high, these wonderful travellers scale, leaping—by means of the muscular power and the peculiar formation of the after part of their bodies—from the lower to the higher part of the stream. The "leap of the salmon" must be familiar to all who have wandered by the course of any large streams. Arrived at a suitable spot, and where fresh pure water flows, the salmon picks out a place where it can make a furrow, worthy of being entrusted with the ova which are to continue the race. The furrow is made, the ova are deposited, and the trench is covered by the salmon with gravel from the river bed. For awhile the parent remains in fresh water, but when long fasting and the enervating influence of fresh water have had their work upon the fish, he returns about the spring time by the way that he came, and seeks in the briny waters of the sea freedom from accumulated parasites, and

the source of new life. Other fish, indeed, it may be said all fish, travel also, though less demonstratively. The flying-fish, already described in the WORLD OF WONDERS, travels far and wide within the tropics to escape from the jaws of his enemies, and his enemies follow as far and farther than he can go, in order to feast upon his delicate flesh. Porpoises—sea-pigs as they are called—travel far and rapidly, going in "schools" at a rate that mocks the quickest steamer, and, according to the sailors, in the direction from which the wind is going to blow—these sagacious animals, so Jack says, having a wholesome dread of a lee-shore.

Most fish are given to travel, but not all. The tribe might be divided into fish of passage, and fishes residentiary, the former being, as might be expected, by far the more interesting, both naturally and gastronomically; while the others, like many other stay-at-homes, are flat, stale, and unprofitable.

Antiquarian Curiosities.

CURIOUS ANCIENT SUPERSTITION. — In a volume containing miscellaneous collections by Dr. Richard Pocock, in the British Museum, is the copy of a letter written by Philip Herbert, third Earl of Pembroke, Lord Chamberlain in the reign of King Charles I., to the Sheriff of Staffordshire, which illustrates a curious popular belief of the period, from which even the king was not free. It runs as follows:—"Sir, His Majesty taking notice of an opinion entertained in Staffordshire, that the burning of ferne doth draw downe rain, and being desirous that the country and himself may enjoy fair weather as long as he remains in those parts, his Majesty hath commanded me to write unto you, to cause all burning of ferne to bee forborne, until his Majesty be passed the country. Wherein, not doubting but the consideration of their own interest, as well as of his Majesties, will invite the country to a ready observance of this his Majesties command, I rest your very loving friend, —PEMBROKE & MONTGOMERY. Belvoir, 1st August, 1636."

THE INTRODUCTION OF TOBACCO INTO ENGLAND.—Old John Aubrey thus writes of the "Indian weed:" "Sir Walter Raleigh was the first who brought tobacco into England, and in our part of North Wilts it came first into fashion by Sir Walter Long. They had first silver pipes. The ordinary sort made use of a walnut-shell and a straw. I have heard my grandfather say that one pipe was handed from man to man round the table. Sir Walter Raleigh, standing in a stand at Sir R. Poyntz's park at Acton, took a pipe of tobacco, which made the ladies quit it till he had done. Within these thirty-five years 'twas scandalous for a divine to take tobacco. It was sold then for its weight in silver. I have heard some of our old yeomen neighbours say that when they went to Malmesbury or Chippenham market, they culled out their biggest shillings to lay in the scales against the tobacco; now the customs of it are the greatest his Majesty hath."

YOUNG PEOPLE SOLD IN ENGLAND.—In the life of Wulfstan, Bishop of Worcester, who died in the year 1095, it is stated that in a town called Brickston (now known as Bristol) there was a mart for slaves, who were collected from all parts of England—and particularly young women; that it was a most moving sight to see in the public markets rows of young people of both sexes, of great beauty, and in the flower of their youth, tied together with ropes, and sold—men, unmindful of their obligations, delivering into slavery their relations, and even their own children. Wulfstan, by his exertions, put an end to this barbarous custom.

PANICS.

THE credulity of people where money, or money-making, is in question, seems to be boundless. Ever since facilities were given to monetary speculation by the development of the banking system, and by the establishment of associated credits, there have been recurring periods of wonderful credulity wonderfully deceived. With William III. the banking system may be said to have begun in England, and in his successor's reign—even in his own—we find the beginning of that wonderful series of speculative manias of which we find too many instances in our own times.

The Darien scheme, as it was called, was a speculation of a kind reasonable in itself, and one which might, under circumstances that did not present themselves, have proved very successful. It was conceived by William Paterson, a Scotchman, in the year 1695, and had for its object the establishment of a great commercial city on the Isthmus of Darien, which should be a depôt and medium of intercommunication for the commerce of the eastern and western hemispheres. The company who were to found the city were to make their fortunes as traders, a monopoly having been given to them by the Scotch Parliament. The ferment in Scotland was prodigious; "almost in an instant £400,000 were subscribed in Scotland, although it is known that at that time there was not above £800,000 of cash in the kingdom." It was anticipated that the whole Indian trade would pass by the Darien route. A settlement was made on the isthmus, and arrangements were made for carrying out the scheme; but difficulties of all sorts arose. Persons interested in the old channels of trade intrigued against the new company; speculators

shut out of the speculation murmured against it, and the Spaniards, apprehensive of danger to their central American colonies, took steps to overthrow the company's factories. The prejudices of the king—William III.—were excited against the company, so that he not only withdrew all support, but expressly disowned the Darien colony and forbade assistance to be sent to it. The scheme naturally failed under these adverse influences, the colonists succumbed to Spanish force, and the luckless investors in the company's stock—who were thousands in number—were utterly ruined.

Born of the excitement consequent upon the Darien scheme was the Mississippi scheme, devised by John Law, the son of an Edinburgh banker. Law, by the introduction of a paper currency, had so far relieved the dire distress of the French national finances, as to ingratiate himself with the government of the regent, under whose auspices he started the Royal Bank of France. Plausible, clever, and enthusiastic, he devised all sorts of schemes for the purpose of relieving the general pecuniary distress—the most celebrated being that known as the Mississippi scheme. A company formed by him obtained a grant of all the territory, then belonging to France, through which the Mississippi river flowed. From this land tobacco, corn, and all sorts of produce were to be obtained; the shareholders were to make fortunes rapidly; and the money acquired by them was to flow out again in a fertilising stream over the country. Engrafted upon this company were other companies, including the old French East India Company; and trading monopolies were granted to it which made it the most considerable and powerful private association in the world. All France, from the minister to the peasant, took shares in it; the stock went up to a premium of an absurd height; all the available money and all the credit of the country were wrapped up in it. It was incorporated with the Royal Bank. The wealth amassed by Law, and by those speculators who knew the market, was enormous; and the envy excited was proportionately great. Competition in the race for riches sent up the stock to fabulous prices, and in January, 1720, the 500 livres shares were selling for 10,000 livres each. Suddenly there was a suspicion that all was not well, a drain on the bank ensued, and then came a panic. Those who could realise did so immediately, and sent their money out of the country; the run on the bank continued, and on the 27th of May, 1720, specie payments were stopped. The ruin was universal; all France was concerned in it, nor did it recover from its effects until the restoration of credit by Napoleon, eighty years afterwards. Law himself fled to Brussels, his sole wealth a diamond, worth £5,000. All his estates, all his heaped-up riches were confiscated, but made a poor compensation for the ruin their owner had occasioned.

The same year that saw the Mississippi scheme fail saw the rise of the South Sea scheme. In 1711 a company had been formed in London, of which the object was to undertake the payment of £10,000,000 of the national debt in return for a monopoly of trade in the Pacific Ocean. Little or no trade was done, but as a moneyed association the company took to "financing" on a stupendous scale, undertaking among other things to pay off the national debt of £31,000,000 on terms sanctioned by Parliament and very advantageous to the shareholders. The speculative frenzy of the Mississippi scheme was extended to this country. South Sea stock rose in one day from 130 to 300, and subsequently went up to 1,000. The rush for shares was wonderful, considering recent experiences; "It seemed at that time as if the whole nation had turned stock-jobbers. Exchange Alley was every day blocked up by crowds, and Cornhill was impassable from the number of carriages. Everybody came to purchase stock—'Every knave aspired to be a fool.'"

After a few months came the crash, with its concomitants of despairful ruin, and cries for revenge. Expulsions took place from Parliament, peers were impeached, the criminal law was set in motion, fines were inflicted, but ruin stayed behind.

The wars which occupied Europe for the next ninety years elbowed out speculations, but with the return of peace came money mania again. In 1824-5 and 1845-6 joint-stock bubble mania was the epidemic, and thousands of people were ruined. And yet, in spite of experience, it would seem that people will continue to "plunge" whenever and as soon as they are beginning to recover from the effects of the last cold immersion in the waters of want. We are not yet recovered from the dire distress occasioned by the last money fever, though there are signs that some among us have not been sufficiently punished to make us proof against future temptation.

CURIOSITIES OF COFFEE.

All the coffee consumed in the European and American world was originally derived from Arabia. The plant, however, is not a native of Arabia, but of Abyssinia, and was not introduced into the former country until A.D. 1454, and, consequently, not until eight centuries after the time of Mahomet. The Arabians found coffee to be stimulating and agreeable, and, substituting it for forbidden wine, called it *kawah*, of which the European name coffee is a corruption through the Turkish; the word in Arabic meaning wine. Thereupon the Mahometan doctors fell to dispute about the legality of the potation. Coffee is not narcotic, but the contrary; the Arabian theologians, however, occupied themselves

with the name, not the thing. In the end, the wholesome and agreeable beverage beat the doctors, and for nearly four centuries the use of coffee has been orthodox and extensive in Arabia. About the middle of the fifteenth century coffee was introduced from Arabia into Egypt, and from thence it spread over the rest of the Turkish empire. A Turkish merchant, one Edwards, brought the first bag of coffee to England in 1650, or 1652, and in the same year his Greek servant made the first cup of English coffee. About the same period it was introduced into France. In sixty years' time it was familiarly known in England, at least in fashionable society, as we find from Pope's well-known lines in the "Rape of the Lock."

> "Coffee, which makes the politician wise,
> And see through all things with his half-shut eyes."

For at least half a century Arabia, which now furnishes less than one two-hundredth part of what is consumed, yielded the whole supply. In the year 1690 a certain Dutch governor-general of India, one Jan Camphuis, sent as a curiosity to Holland a single coffee-plant, which he had raised by seed at Jeddah, in Arabia. The plant in question was carefully reared in a hot-house at the Hague, and bore fruit. Some berries from it were sent to Surinam, and these berries are the progenitors of the whole coffee plantations of America and its islands, the produce of which amounted, in 1850, to 295,000,000 of pounds weight. The coffee-plant, or plants, which the Dutch governor kept to himself, have been also tolerably prolific, for they furnished, in 1850, in Java, Ceylon, Sumatra, Celebes, and the Philippines, 181,000,000 of pounds.

There is, however, another version of the West Indian supply. It is said to have been owing, in some measure, to a distinguished French botanist that we are so abundantly furnished with the coffee-berry. Two plants were, under his care, taken to the West Indies from the Botanic Gardens at Paris, but on the voyage the supply of water became nearly exhausted, when this person was so anxious to preserve the plants that he deprived himself of his own allowance in order to water the coffee-plants. From these two, it is added, all the coffee grown in the West Indies has sprung.

The first coffee-plant known in Brazil was cultivated by a Franciscan monk of the name of Velloso, in the garden of the convent of St. Antonio. The monk presented its fruit to the viceroy, the Marquis of Lavrado, who judiciously distributed it to the planters. This was in 1774.

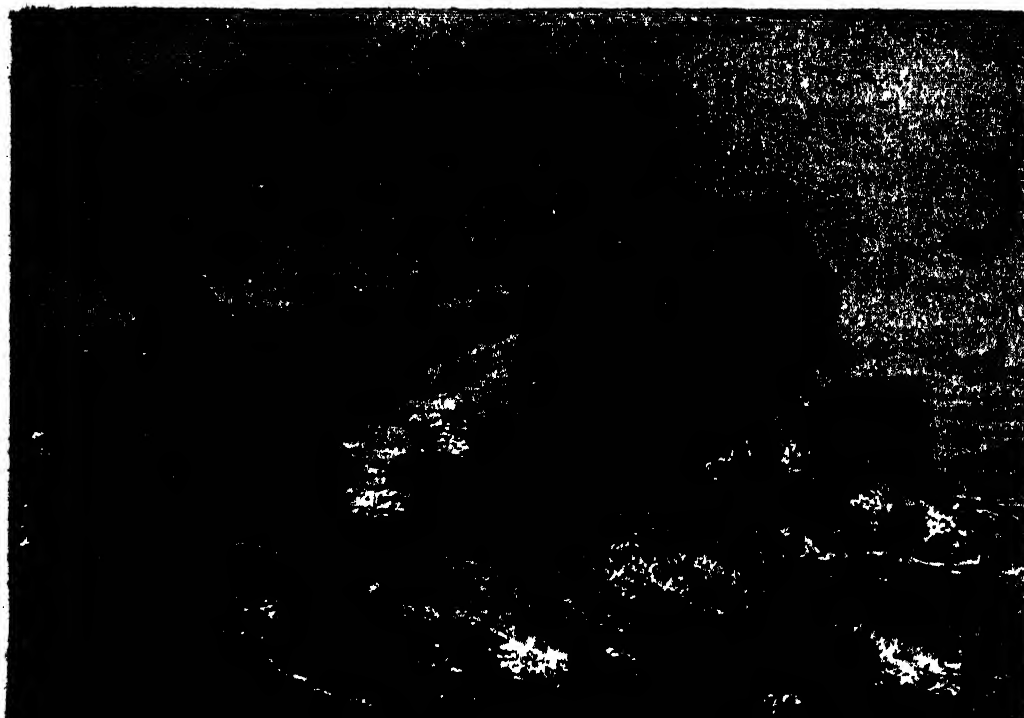
From Africa to Arabia, to Java, to Holland, to America and its islands, chance alone seems to have guided the culture of coffee, now of such vast magnitude. There seems nothing mightier about the history of its introduction than the curiosity of a Dutch functionary, and the horticultural taste of a Creole Portuguese monk.

WONDERFUL RIVERS.

THE Mississippi, by constantly overflowing its banks in some parts of its course, accumulates large masses of silt and mud, which soon become covered with grass and trees, so as to form islands of different shapes and sizes. Some years since, these islands were numbered; but it was soon found that every now and then the river undermined and overwhelmed many of them, while others were constantly being formed. Some of the islands are very old, and have very large trees upon them, which do not float when they fall into the river on the destruction of their supporting land, but remain with their heavy roots sticking in the mud at the bottom. The trunks are very dangerous to boats going up the stream, and many steamers have been lost by rushing full speed on to "snags," as the sunken trees are called. When there are many snags in the river between small islands, the trees and bushes which are constantly being swept down by the current from the banks of the streams higher up, collect, from being stopped. After a time, the amount of timber thus brought together is so great, that large stationary rafts are formed. One raft grew to an immense size in one of the branches of the Mississippi, and increased steadily for thirty-eight years. It was ten miles long, 220 yards wide, and eight feet deep. The whole rose and fell with the water, and was covered with green bushes and trees, while its surface was enlivened in the autumn by a variety of beautiful flowers. It went on increasing till about 1835, when some of the trees upon it had grown to the height of about sixty feet. Steps were then taken by the State of Louisiana to clear away the whole raft and open the navigation, which was effected with great trouble and cost, in the space of four years.

Much mischief is often done by the snags collecting in the smaller rivers, and from the sand forming banks around them. In the Red River, large cedar and pine trees collect round the snags with their roots downwards, and they stop the current, which then begins to deposit mud and sand. A mud-bank soon rises, and young willows and cotton-wood trees spring up, their boughs keeping back the stream when it is unusually high. The bank continuing to enlarge, the channel at length becomes so narrow that a single long tree may reach from side to side. The remaining space is then soon choked up by a quantity of timber which has become water-logged and sunk. In 1860, a raft or dam of this kind kept back the stream of the river for twenty or thirty miles, and obliged the greater part of the water to pass into a side lake. The plains of the Red River and the Arkansas are so low and flat, that when the main river into which they fall—the Mississippi—is much flooded, an immense space of country is inundated. The sediment of the streams is

because it comes from the wear and tear of rocks which have a red tint like some granites. In 1833, a swamp was formed near the Mammelle Mountain, of 30,000 acres in extent. Innumerable trees, for the most part dead, are now to be seen there, of cypress, cotton-wood, or poplar, the triple-thorned acacia, and others which are of great size. Their trunks appear as if painted red for about fifteen feet from the ground, at which height a perfectly level line extends through the whole forest, marking the rise of the waters during the last flood.



FLOATING RAFT ON THE MISSISSIPPI.

Many earthquakes occur on the sides of the Mississippi, and the result has been that great plains have sunk year after year a little, and the river has overflowed them and deposited its fine sediment. As the plains descended, the silt increased, and finally great depths of it formed. Moreover, in some places, the plains which have thus been covered have been gradually lifted up again, and have become hills, through which the river has had to cut its way. Thus at Vicksburg, where there [illegible] the bluffs or cliffs, are very high, and are composed of the silt of the river mixed with snail and other shells, and fish-bones. In spite of all these floods and changes in the level, the sides of the river are full of life. Herds of wild deer graze on the pastures, or browse on the trees. The bear, the wolf, the fox, the panther, and the wild cat, still maintain themselves in the dense forests of cypress and gum trees. The racoon and the opossum are everywhere abundant, while the musk-rat, otter, and mink still frequent the rivers and lakes, and there are a few beavers and buffaloes which have not yet been driven away. The waters teem with alligators, tortoises, and fish, and their surface is covered with millions of waterfowl, which perform an annual voyage from Canada down the river into the Gulf of Mexico.

No one can form an idea of the effects of the everlasting rush of the waters of this mighty river upon the surrounding country, or what torrents of stones and acres of mud it carries down to the sea year by year.

The [illegible] its banks like the

Mississippi, and carries a long train of wreck into the sea. How this is done was described by Mr. Bates. When up the river, he was awoke before sunrise by an unusual sound resembling artillery, and supposed it to be an earthquake; for although the night was calm, the river was much agitated. At daybreak, large masses of forest, including trees of immense size, probably 200 feet in height, were rocking to and fro, and falling headlong, one after another, into the water. After each fall, the wave which it caused returned to the crumbling bank with tremendous force, and caused the fall of other masses by undermining. The line of shore over which the landslip extended was a mile or two in length. It was a grand sight; each downfall created a cloud of spray; the concussion in one place causing other masses to give way a long distance from it; and thus the crashes continued, swaying to and fro, with but little prospect of their ending. Two hours after, when he left, the destruction was still going on. The Amazon sends such a large body of fresh water and sediment into the Atlantic Ocean that it is coloured for a vast distance by it. In 1822 it was found that at a distance of 300 miles from the mouth of the river, and therefore far out at sea, the original direction of the fresh water current was hardly altered. The current moved out at the rate of nearly three miles an hour, and was not much mixed with the salt water. The river Plate, another vast stream, falls into the ocean with such velocity that its waters can be distinguished from those of the sea at a distance of 600 miles, and for a breadth of 800 miles.

PRINCE RUPERT'S DROPS.

These philosophical toys take their English name from having been first made known in England by Prince Rupert, and not from his having invented them, as commonly supposed. Beckmann considers it more than probable that these drops and their singular properties may have been known from time immemorial. All glass, when suddenly cooled, becomes brittle, and breaks on the least scratch. A drop of fused glass falling into water might easily have given rise to the invention of these drops.

They were first brought to England in 1660, and shown to the Royal Society. They were well-known when "Hudibras" was written, thus:—

> "Honour is like the glassy bubble
> That finds philosophers such trouble;
> Whose least part crack'd, the whole does fly,
> And wits are crack'd to find out why."

Edward Clarke, who brought the drop from Holland, says:—"The drop, when taken hot from the fire, is suddenly immersed in some appropriate liquor (cold water, he thinks, will break it), by which means the pores on the outside are closed, and the substance of the glass condensed; while the inside, not cooling so fast, the pores are left wider and wider from the surface to the middle, so that the air being let in, and finding no passage bursts it to pieces." To prove the truth of this explanation, he observes, "That if you break off the very point of it, the drop will not burst, because that part being very slender, it was cooled all at once, the pores were equally closed, and there is no passage for the air into the wide pores below. If you heat the drop again in the fire, and let it cool gradually, the outer pores will be opened and made as large as the inner; and then, in whatever part you break it, there will be no bursting."

Rupert's drop is thus described in the *Philosophical Transactions*:—"The bubble is in form somewhat pear-shaped, or like a leech; it is formed by dropping highly-refined green glass, when melted, into cold water. Its end is so hard that it can scarcely be broken on an anvil; but if the smallest particle of its taper end is broken off, the whole flies at once into atoms, and disappears. The theory of this phenomenon is, that its particles, when in fusion, are in a state of repulsion; but, on being dropped into the water, its superficies is annealed and the particles return into the power of each other's attraction; the inner particles, still in a state of repulsion, being confined within their outward covering." Faraday was in the habit of illustrating the incompressibility of water by Prince Rupert's drop. When one was placed in a vial of water, and the end broken off, the force of the concussion from the disruption of the drop shattered the glass vial.

Glass is broken by sand in this manner. In some glass-houses the workmen show glass which has been cooled in the open air; on this they let fall leaden bullets, without breaking the glass. They afterwards desire you to let a few grains of sand fall upon the glass, by which it is broken into a thousand pieces. The reason of this is, that the lead does not scratch the surface of the glass; whereas the sand being sharp and angular, scratches it sufficiently to produce this surprising effect.

ANCIENT BRICK BUILDINGS.

At Rome the common houses were generally built of unburnt bricks, while the body of nearly all the public buildings was of burnt brick faced with marble or stone. Very few specimens of brick, as a means of decoration, have come down to us, although we find that the temple of the god Redicolus, in the valley of Egina, is all of brick, beautifully executed. Augustus, we are told by Suetonius, boasted of having left Rome of marble, which he had found of brick. The castle of St. Angelo, the campanili of St. Mark's, and the interior of the Colosseum are celebrated specimens of brick-work.

Among other ancient nations the Chinese have been celebrated for their great wall, built of burnt brick, which most resembles the wall of Media. The extent is computed at 1,500 miles over a rugged and mountainous country. One elevation is upwards of 5,000 feet, or a mile high. The usual height of the wall is thirty feet, and at the top it is about fifteen feet thick, paved so that carriages can drive along it. Square towers, sometimes forty feet high, are erected at very short distances. The stone employed in the foundations, angles, &c., is a strong grey granite; but the greatest part of the wall consists of bluish bricks, and the mortar is remarkably white and pure. Its date is about 200 B.C., though the Chinese authorities assert that it has existed 2,000 years. They do not mention the time employed in its construction. A large party from an English steamer inspected the great wall in the summer of 1850, and reported it to be in various states of preservation, while it was found in some places to be an earthern wall faced with bricks. They mention an arched granite doorway, the construction of which is most remarkable, for the Chinese have long ceased to use the keystone in their arches.

In all probability the art of moulding and burning bricks was never lost. We find brick buildings in all parts of Europe, dating from the first century of our era. In the fifth century the palace of Theodoric, at Ravenna, was built of brick, and nearly the whole of the campanili of that city are circular and of brick. At Rome all the campanili previous to the Renaissance period are built of brick, and in Pisa, Bologna, Siena, Venice, Verona, and many other towns, ornamental brick buildings may be found. The first modern brick house in England is said to be at Little Wenham, in Suffolk, date about 1260.

The Roman bricks used in the buildings on the Palatine Hills, in the baths of Caracalla, and in various remains of Roman buildings in England, are more like tiles than bricks, being very thin compared with their length and breadth. In situations where the soil gave peculiar advantages, brick-making has been carried on for many centuries. Thus, the making of bricks and tiles at York was very considerable, and there are large brick-yards and potteries at York to the present day. Masses of Roman brick-work still remain in England. A Roman city, already described in these pages, has been traced in Shropshire; and Silchester, in Hampshire, presents us with specimens of the brick-work of our Roman conquerors.

Near the Memnonium are several masses of sun-dried bricks; these are the same alluded to in the Bible, at the making of which the captive Israelites toiled in Lower Egypt, and, as some have imagined, at Thebes, from representations of the process of making them which are painted in the tombs. They are made of clay and chopped straw, as mentioned in the Scripture account, and they retain their original form after a lapse of three thousand years. Several of these bricks are preserved in the British Museum.

Wonders of Natural History.

A WONDERFUL COCKATOO.—There is a great cockatoo in one of the islands of the Indian Ocean, near New Guinea; it is as large as a full-grown pheasant, and it is of a jet-black colour. The bird is remarkable for its immensely strong bill, and the clever manner in which it is used. The bill is as hard as steel, and the upper part has a deep notch in it. Now the favourite food of this cockatoo is the kernel of the Canary nut; but there is wonderful ingenuity required to get at it; for the nut is something like a Brazil nut, but it is ten times as hard. In fact, it requires the blow of a heavy hammer to crack it; it is quite smooth, and somewhat triangular in shape. The cockatoo might throw the nut down, but it would not break, or it might hold it in its claws like parrots usually do with their food, and attempt to crush it; but the smoothness of the nut would cause it to fly out of the beak. Nature appears to have given the possessor of the wonderful bill some intelligence to direct its powers; for the cockatoo takes one of the nuts edgewise in its bill, and by a sawing motion of its sharp lower beak makes a small notch on it. This done, the bird takes hold of the nut with its claws, and biting off a piece of leaf, retains it in the deep notch of the upper part of the bill. Then the nut is seized between the upper and lower parts of the bill and is prevented slipping by the peculiar texture of the leaf. A sharp nip or two in the notch breaks off a tiny piece of the shell of the nut. The bird then seizes the nut in its claws and pokes the long sharp point of its bill into the hole, and picks out the kernel bit by bit. The cockatoo has a very long tongue, which collects each morsel as it is broken off by the bill. This is a wonderful process, for it is quite clear that without the leaf nothing could be done, and it proves how certain structures in birds are made to destroy certain parts of plants.

VARIETY OF BIRDS IN WESTERN AFRICA.—The parrot is by far the most extensive of the feathered tribe—from the grey parrot to the beautiful green love-bird. In plumage the variety is most extraordinary; and, as they flit in the noonday, their gaudy, beautiful colours add to the grandeur of the scene. By the margins of the lakes and swamps are seen the stately storks, the cranes, the curlew, the pelican, and the prince of African birds—the crown-bird. On the broad, calm waters are wild ducks, teal, and widgeons; soaring aloft in the neighbourhood of towns, the turkey buzzard and

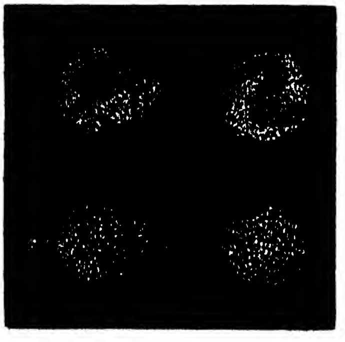
members of the eagle tribe, to both of which a superstition is attached by the natives—a certain dread of consequences if destroyed, enforced by the government in order to retain these useful scavengers.—*Forbes's "Mission to Dahomey."*

VORACITY OF MOLES.—Moles (says Cuvier) are so voracious as not even to spare their own species. If two are shut up together without food, there will shortly be nothing left of the weakest but its skin slit along the belly.

A GLOBE OF GAS IN THE HEAVENS.

IT is only on a clear, fine, moonless night, when the stars glitter like diamond points upon a black background, when there is no thin mist in the air, and when the Milky Way shines in its delicate beauty like a stain of light in the sky, that the objects described in this paper can be seen.

But an observer, gifted with the keenest sight, would be utterly unable to discover, without the aid of a telescope, the slightest trace of the wonderful phenomenon we have figured in the illustration. He might weary himself with staring even at the exact spot in the heavens where one of these objects is situated, but not the faintest glimmer would reward his efforts. He must call in the aid of that indispensable requisite to the astronomer—the telescope—to assist him. And even a telescope of such dimensions as is usually seen would be of no use; it requires a telescope of very considerable power to show these objects at all. To show them well, tasks the utmost powers of a very first-rate instrument, such as is seldom met with. To reveal, however, the full beauty of their marvellous bodies, to exhibit them with brilliancy and clearness sufficient to show the amount of detail with which they are figured in the engravings required the whole power of the great instrument of the Herschels, or the colossal telescope of Lord Rosse.



GLOBES OF GAS.

Let us suppose that an observer who enjoys the privilege of looking at the heavens through an instrument such as that last mentioned, directs the telescope on one of these bodies. At first, perhaps, he has a little difficulty in distinguishing it from a star, but when a higher magnifier is applied at the eye end of the telescope the difference is wonderful. He sees a very minute round ball, very bright, and glowing with light of a blue colour. If he turn to another of these curious objects he will see a ball, slightly different perhaps in size, or brilliancy, or colour, perhaps with very faint markings upon it, but he will find the general features in all these bodies to be the same. The observer can clearly see that this ball he is looking at is not made up of stars, and then the idea gradually bursts upon him that the object must be a globe of gas.

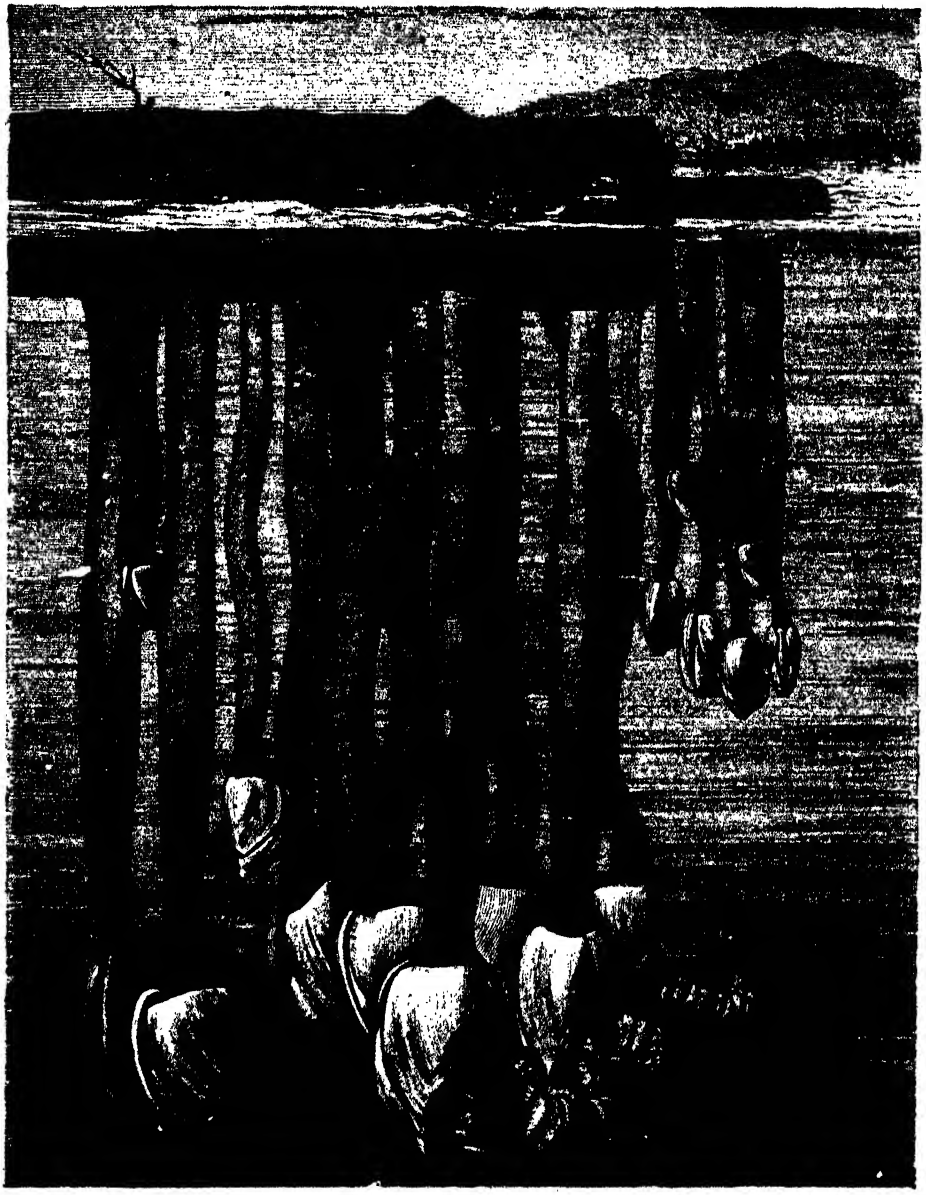
That this is the real nature of these objects recent discoveries have placed beyond all doubt. As we recover our astonishment at this wonder, a crowd of questions occur to us. How far off is this globe we are gazing at? All we know is, that its distance from the earth must be incalculably great. This question science cannot answer with accuracy. It is probably far more remote than most of the stars which we can see without a telescope, but even of this we cannot be quite sure. How large is it? To this also we must plead our ignorance. Knowing, however, that its distance is enormously great, we very naturally infer that it must be proportionately huge, since we are able to see it at all. But supposing that we take the vast circle which the earth describes around the sun, a circle, the diameter of which is nearly two hundred millions of miles, and supposing that a globe were conceived so large that it would only just pass through this circle, then we know for certain that the globe of gas must far exceed this imaginary globe in bulk.

How is it that the gas is seen, and what renders it luminous? Gases, as we know them on this earth, are transparent or invisible; how is it, then, that this globe, if it be of gas, emits this lovely, blue light? To this we answer that the gas is heated so hot that it becomes luminous, just as iron when heated sufficiently gives out light. Difficult, indeed, it is to form a notion of these wonderful bodies. They are utterly different from the sun, from the moon, from the planets which, relatively speaking, are quite near to us. There is no terrestrial object to which we could refer as an illustration. They are peculiar and unique bodies in the universe.

There are in the heavens about twelve of these curious objects, varying somewhat in size and also in shape and colour, but the general features in all are pretty much what we have thus briefly described. They are denominated, along with many other curious celestial bodies, by the word nebulæ; but, to distinguish them from the great majority of the nebulæ, we call them *planetary nebulæ*. It must not, however, be inferred that they are connected with the planets; the only reason why this name is given is that, seen through a telescope, both the planets and the globes of gas present a sharp, round outline. Our illustration will give the reader some idea of their shape and appearance.

BARNACLES.

It requires a good deal of faith to believe that barnacles are related to crabs, for they are not the least alike, and the first is fixed like a shell-fish on to pieces of timber floating about in the sea, or to the rocks washed by the tide; whilst the last has legs, claws, eyes, and the power of moving and swimming. Yet it is quite true that the barnacle to the same class of animals that includes the crabs, shrimps, and lobsters. If a piece of rock is put into a large glass full of sea-water, many things may be seen on it which are of a white colour, and whose shape is something like that of a thimble with the top battered in. If they are examined, it becomes evident that the conical outside is formed of several little bits of hard shell joined together very carefully, and that the top has a valve in it. When the water is quite clear and quiet, a small flapper is poked out through the



BARNACLES.

valve, and is moved to and fro with a motion like that of opening and shutting the fingers. The flapper has some long bristles attached to it, and they are beautiful, feathery-looking things when examined under a microscope. The movement goes on for hours, and ceases upon the least alarm. Then the flappers are withdrawn, the valve closes, and the barnacle—for such is the creature—looks again like a conical piece of stone. The flappers are the lungs as well as the hands of the barnacle, and minute living creatures are entangled by them and passed by a current of water into the mouth, which is within the shell. When the barnacle produces its eggs, it ejects them with a stream of water, and they float about in the sea, being very minute things. They soon become hatched, and then it is that the reason becomes clear why barnacles and crabs are placed by zoologists in the same class. The young barnacle is just like a shrimp, with a long body, many long legs close to its head, and a large tail; it has eyes, and swims about most vigorously. It appears to be constantly in movement, and although actively employed in swimming and in crawling, it does not care to seek for food. After awhile, the young free-swimming creature rests upon a piece of rock, or wood, or even on the back of a fish, and then a wonderful alteration takes place. The long legs and feelers near the head grasp the substance on which the creature is to live for the future, and a gummy substance comes from a gland which has been growing for some time close to the head. The gum sticks the legs and the feelers to the substance, the eyes diminish in size and are no longer seen, the tail and the hind legs grow into the feathery flappers already noticed, and the shell of many pieces encloses all. The barnacle is then fixed for life, head downwards, and it loses its organs of sight and receives a mouth and stomach, which it had not before, when in the free-swimming state. All barnacles do not undergo this change, for the males of some kinds live inside the conical house which holds the female, and never have houses of their own, for they remain in the free-swimming form. All the animals of the crab class have to undergo a change of form before arriving at maturity, and the common shore crab, when it is first hatched, is a long thing with a great head, and legs fitted for swimming, and not for crawling. As it grows, the body shortens by curling the tail end underneath, and the legs and claws grow out of the swimming apparatus. Some of the barnacles that live on coral reefs are very beautiful, and their shells are ornamented in imitation of the flower-like polypes of the stony madrepores.

The illustration on the preceding page will give the reader a good idea of the appearance which a family of barnacles presents, clinging to the under surface of a floating log.

Curiosities of Savage Life.

Esquimaux Daring.—The roving and courageous habits of the Esquimaux are strikingly illustrated in the following passage from M'Lean's narrative of "Service in the Hudson's Bay Territories:"—"A greater number of Esquimaux were assembled about the post (on the south side of Hudson's Straits) than I had yet seen; and among them I was surprised to find a family from the north side of the Strait, and still more astonished when I learned the way they had crossed. A raft, formed of pieces of drift-wood picked up along the shore, affording the means of effecting the hazardous enterprise. On questioning them what was their object in risking their lives in so extraordinary an adventure, they replied that they wanted wood to make canoes, and visit the Esquimaux on the south side of the Strait. 'And what if you had been overtaken by a storm?' said I. 'We should have gone to the bottom,' was the cool reply. In fact, they had had a very narrow escape, a storm having come on just as they landed on the first island. The fact of these people having crossed Hudson's Straits on so rude and frail a conveyance, strongly corroborates, I think, the idea that America was originally peopled from Asia. The Asiatic side of Behring's Straits, affording timber sufficiently large for the purpose of building boats or canoes, there seems nothing improbable in supposing that, when once in possession of that wonderful and useful invention, a boat, they might be induced, even by curiosity, to visit the nearest island, and thence proceed to the continent of America."

The Amazons of Dahomey.—The Amazons, or women-soldiers of the King of Dahomey, are not supposed to marry, and what the males do the Amazons will endeavour to surpass. They all take great care of their arms, polish the barrels, and, except when on duty, keep them in covers. There is no duty at the palace, except when the king is in public, and then a guard of Amazons protects the royal person. On review he is guarded by the males, and outside the palace there is always a strong detachment of males ready for service. In every action there is some reference to cutting off heads. In their dances—and it is the duty of the soldier and the Amazon to be a proficient dancer—the right hand is working in a saw-like manner for some time, as if in the act of cutting round the neck, when both hands are used, and a twist is supposed to finish the bloody deed. In a review of the Amazons, one regiment was distinguished by a white cap with two devices (blue alligators), another by a blue cross, while the third had a blue crown. The officers were recognised by their coral necklaces and superior dresses, while each carried a small whip, which they plied very freely when

required. After being inspected, they commenced an independent firing, whilst at intervals, rushing from their ranks, many of them would advance to the foot of the throne, address the king, hold aloft their muskets, and then return and fire them.—*Forbes's "Dahomey and the Dahomans."*

DWARFS.

WHILE the Bible makes mention of several giants, and gives the most minute particulars as to their huge proportions and marvellous strength of body, we only once find mention of a dwarf in the sacred pages, and then the reference is only general; no mention is made of any particular man or men of such unnaturally small size. The passage referred to is in Leviticus, where the service of the altar is defended from all blemished persons, amongst whom "a dwarf" is included. Still, we find mention made of dwarfs in very early times.

The custom of having them at court is very ancient. The Egyptians had these diminutive persons in their suite; and the Romans were great admirers of them, although they attributed to them an intellectual capacity little higher than that of monkeys. The Emperor Augustus had a dwarf named Lucius, who weighed seventeen pounds, had a tremendous voice, and was only two feet high.

Julia, the niece—or, as some say, the daughter—of Augustus, had a male dwarf, named Conopas, two feet and a hand's breadth high. One of Julia's freed maids, Andromeda, was of the same height.

Platerus says of John Decker or Ducker, an English dwarf (1610), "I have his portrait by me, drawn at full length; he was about forty-five years of age, as far as might be discerned by his face, which now began to be wrinkled; he had a long beard, and was only two feet and a half in height, otherwise of straight and thick limbs, and well-proportioned; less than he I have never seen."

Richard Gibson is one of the most celebrated dwarfs of modern times. He was born about the year 1615, and was not only remarkable for his smallness of stature, but for an exceedingly good artistic faculty. He was a pupil of De Cleyn, and imitated Sir Peter Lely. He was appointed drawing-master to the Princesses—afterwards Queens—Mary and Anne. His painting representing the parable of the Lost Sheep was highly prized by Charles I., who gave it to Vandervort to take charge of; Vandervort put it away so carefully that when the king asked for it he could not find it, and fearing his royal master's displeasure, he hanged himself. Richard Gibson married Anne Shepherd, court dwarf to Queen Henrietta Maria. The king gave away the bride, and the queen presented her with a diamond ring. Waller, the court poet, wrote one of his pretty sets of verses on the occasion. It is only right to state that the marriage turned out very happily, and that the little couple had nine children, five of whom were of full ordinary stature.

Jeffrey Hudson, perhaps the most renowned of all dwarfs, was born in 1619, at Oakham, in Rutlandshire. His father and mother were of full height, and Jeffrey was the only one of their family who was in any way extraordinary. Jeffrey's father kept the Duke of Buckingham's baiting-bulls, and the little fellow was presented to the Duchess of Buckingham between the seventh and ninth years of his age, and when he was scarcely a foot and a half in height. It was Jeffrey Hudson who, soon after the marriage of Charles I., when that king and his bride were entertained at Burleigh, was served up to table in a cold pie, whence he jumped on to the table-cloth fully armed, and made passes at the ladies with his little sword; there is a rare old picture of this amusing incident in the dwarf's career. The Duchess presented him on that occasion to Henrietta Maria, who was highly pleased with him and kept him as her dwarf for many years afterwards. Poor Jeffrey was continually squabbling with the people about court, more especially with the giant porter of the palace. Many little anecdotes are told of him, and he appears to have had a largely eventful life for so small a person. On one occasion he was nearly drowned in the basin he was washing his face and hands in; another time a large shrub was the only obstacle between his little person and death by drowning in the Thames. In 1630 he was dispatched on a domestic mission for Henrietta Maria, and returning richly laden with presents from Mary of Medicis to her daughter, he was made prisoner by Dunkirk privateers.

Jeffrey fought a duel with a Mr. Crofts, who came to the rendezvous armed with nothing more formidable than a squirt—considering so small a personage beneath his notice. Jeffrey, who was not inclined to submit tamely to such an insult, insisted upon fighting a real duel, and shot his antagonist dead immediately. Jeffrey's portrait was painted several times by Mytens and Vandyke; and his smart little waistcoat, breeches, and stockings, are preserved in the Ashmolean Museum, at Oxford.

Matthew Buchinger was another celebrated dwarf, with neither hands, feet, legs, nor thighs; he had, however, two excrescences like fins growing from his shoulders, with which he wrote and performed many curious tricks, amongst which may be mentioned drawing pictures with a pen, playing at dice, playing on the hautboy, threading needles, playing at cards, blowing a trumpet, &c.

Joseph Boruwlaski, commonly called Count Boruwlaski, was remarkable for his wit and smart

little repartees. He went to see the great Empress Maria Theresa when about fourteen years of age and twenty-eight inches high. The empress took him on her lap, and asked what was the most wonderful sight he had seen at Vienna. He answered, "To see such a little man on so great a lady's lap." The empress had a splendid diamond ring on the hand in which she held one of Boruwlaski's. Seeing him apparently absorbed in admiration of the jewel, she asked him how he liked it, when he courteously replied that it was not the ring, but the beautiful hand he was looking at, which he wanted to kiss. The empress allowed him the honour, and taking a little ring from Marie Antoinette's finger, she placed it on Boruwlaski's.

The celebrated Bébé, whose real name was Nicholas Feny or Ferry, dwarf of Stanislaus Lesckzinski, the aged dethroned King of Poland, was born at Plaisnes, in the Vosges. He was taken in a plate to be christened, he was so remarkably tiny. At two years old his shoes were only an inch and a half long. Poor Bébé was not long lived; at a very early age he showed signs of decrepitude; at twenty-three he was attacked with a fever, which soon terminated his life, and he died on June 9th, 1764.

A dwarf named Calvin Philips was born at Bridgewater, in the State of Massachusetts, in 1791, who did not weigh quite two pounds, and whose thigh was not thicker than a man's thumb.

David Ritchie, of Tweeddale, was the real character upon whom Sir Walter Scott founded his novel of "The Black Dwarf." David could just stand upright in the door of his house, which was three feet and a half high.

The most celebrated of the recent dwarfs, Charles S. Stratton, known as General Tom Thumb, was born at Bridgeport, Connecticut, on the 11th of January, 1832. He was first exhibited by Barnum, at his old American Museum in New York, and subsequently brought to England, where he was presented to Her Majesty several times. Her Majesty graciously presented him with a souvenir of mother-of-pearl set with rubies, bearing the crown and initials V.R.; and on another occasion the general received a gold pencil-case from the same royal hand. Mr. Barnum, in his Autobiography, gives an extremely amusing and thoroughly American account of his own and Tom Thumb's proceedings in England. The little general acted in a play written for him by Albert Smith, called "Hop o' my Thumb," at the Lyceum and several of the provincial theatres. In France, Barnum states Louis Philippe, the Queen, and the Princess Adelaide to have been very friendly and partial to himself and his ward, and were "as void of ceremony as any well-bred family."

The last public dwarf was Chung, who was exhibited with his giant and amiable companion, Chang, and Chang's pleasant wife. But the giant eclipsed the dwarf in more senses than one; while the former appears to have been an object of admiration for his good temper and great size, the latter, owing to his remarkably ill-favoured appearance, seems to have created feelings nearly akin to disgust in the minds of most spectators.

Wonders of Vegetation.

THE ITCH-WOOD TREE.

DR. SEEMANN, in his recently published "Flora Vitiensis," describes a tree possessed of singularly noxious qualities, found growing in the Fiji Islands and in New Caledonia. The natives of Fiji know it as "kau karo," literally, "itch-wood," and botanists as *Oncocarpus vitiensis*. It attains a height of sixty feet, with a girth of two or three feet, has white wood, useful for making canoes, &c., a green bark, and a curious corky fruit, somewhat resembling the seed of a walnut. Its milky sap is corrosive and dangerous, but notwithstanding its poisonous properties, it appears that the tree is much sought after by the natives, for building purposes. In handling fresh specimens, should a drop fall upon the hands, it is said to produce a pain equal to that caused by "contact with a red-hot poker." The natives manufacture a poison from the juice.

Mr. E. A. Egerström, in a letter directed to the British consul, describes the effect of this poisonous sap. Wanting a spar suitable for a flag-staff, Mr. Egerström himself stripped off the bark from an oncocarpus trunk, without at the time being aware of the qualities of the sap; he writes: "In the evening I was troubled with considerable itching about my legs, and every part of my body which had come in contact with the spar, especially about the abdomen and lower parts, having sat across the tree when barking it. All the parts affected became red and inflamed, breaking out in innumerable pustles, which emitted a yellowish matter and nauseous smell. The itching was exceedingly painful and irritating, and my arms having been bare when operating upon the tree, also became inflamed, and broke out as already described. The neighbouring natives, who came to watch my proceedings, now warned me, too late, not to touch the tree, as it was a poisonous one, and advised my keeping quiet, and not to touch or scratch the parts inflamed. This advice, however, I could not follow, the irritation for several days being excessive. I employed no remedy, but bathed daily, as usual, in fresh water, although advised to the contrary; and did not get rid of the injurious effects of the itch-wood, for nearly two months."

THE PENGUIN.

THE cold and desolate regions in the neighbourhood of the poles are inhabited by numerous animals who rejoice in the climates of those frozen seas, and flourish under circumstances that would prove fatal to animals less well protected than they are. These animals are nearly all aquatic. The polar bear loves the ice and the icy cold water. His favourite prey, the seal, lives, almost exclusively therein. The waters abound with different kinds of fish which make food for the seals, and for thousands of birds whose sole nourishment they

One of the most curious of these birds, called the king penguin, is the subject of our illustration. He is a most extraordinary creature, not only in appearance, but also in his mode of life. He is upwards of three feet high, and his plumage is short and waterproof. He has no wings, but instead of them small flappers that appear something like arms. His feet are webbed, and placed so far back that when standing he is upright like a man; whereas in ordinary birds the body is more or less horizontal. His flesh is rank and oily, and underneath the skin is a layer of fat, which serves to protect him from the cold.

PENGUINS.

This bird is found in great numbers in Mac-

quarrie Island in the South Pacific Ocean, and a most interesting account of its habits has been given by Mr. Bennett, a naturalist, who visited the locality. The number which inhabited the spot was enormous, but as thirty or forty thousand were continually landing, and the same number going to sea, it was impossible to arrive at an exact estimate. On shore they were arranged as regularly as a regiment of soldiers, and in as compact a manner; the young birds in one place, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth; and so strictly is the order kept, that if a bird of one class intrude itself into the ranks of another it is instantly ejected. Mr. Bennett tells us:—"The females hatch the eggs by keeping them close between their thighs, and if approached during the time of incubation, move away carrying the eggs with them. At this time the male bird goes to sea and collects food for the female, which becomes very fat. After the young is hatched, both parents go to sea and bring home food for it. It soon becomes so fat as scarcely to be able to walk, the old birds getting very thin. They sit quite upright in their roosting places, and walk in the erect position until they arrive at the beach, when they throw themselves on their breasts in order to encounter the very heavy sea met with at their landing place." They lay but one egg, of a whitish colour, and twice the size of that of the goose.

As the penguin has no wings, he is, of course, unable to fly; and as his movements on land are very awkward, the sea is the scene of the display of his powers. In swimming and diving he is unrivalled. Here his abortive wings are of great value to him, they act as fins or paddles which assist his hind feet in propelling him through the water. He sometimes, when coming to the surface after a dive, leaps from the water into the air, and down again like a fish, for which, indeed, in this manœuvre he might easily be mistaken. Fish form his sole food and the food of his young, and his wonderful powers of diving are used in catching them.

Living on islands and in localities uninhabited by man, the penguins have not learned the dread of man which other animals exhibit. Illustrative of this point, Mr. Darwin gives us, in his "Visit to the Falkland Islands," the following interesting account:—"One day, having placed myself between a penguin and the water, I was much amused by watching its habits; it was a brave bird, and till reaching the sea, regularly fought and drove me backwards. Nothing less than heavy blows would have stopped him; every inch he gained he firmly kept, standing close before me erect and determined. While thus opposed he continually rolled his head from side to side in a very odd manner. This bird is commonly called the jackass penguin, from its habit, while on shore, of throwing its head backwards and making a loud strange noise, very like the braying of that animal; but while at sea and undisturbed, its note is very deep and solemn, and is often heard in the night-time. In diving, its little plumeless wings are used as fins, but on the land as front legs; when crawling (it may be said on four legs) through the tussocks or on the side of a grassy cliff, it moved so very quickly, that it might easily have been mistaken for a quadruped."

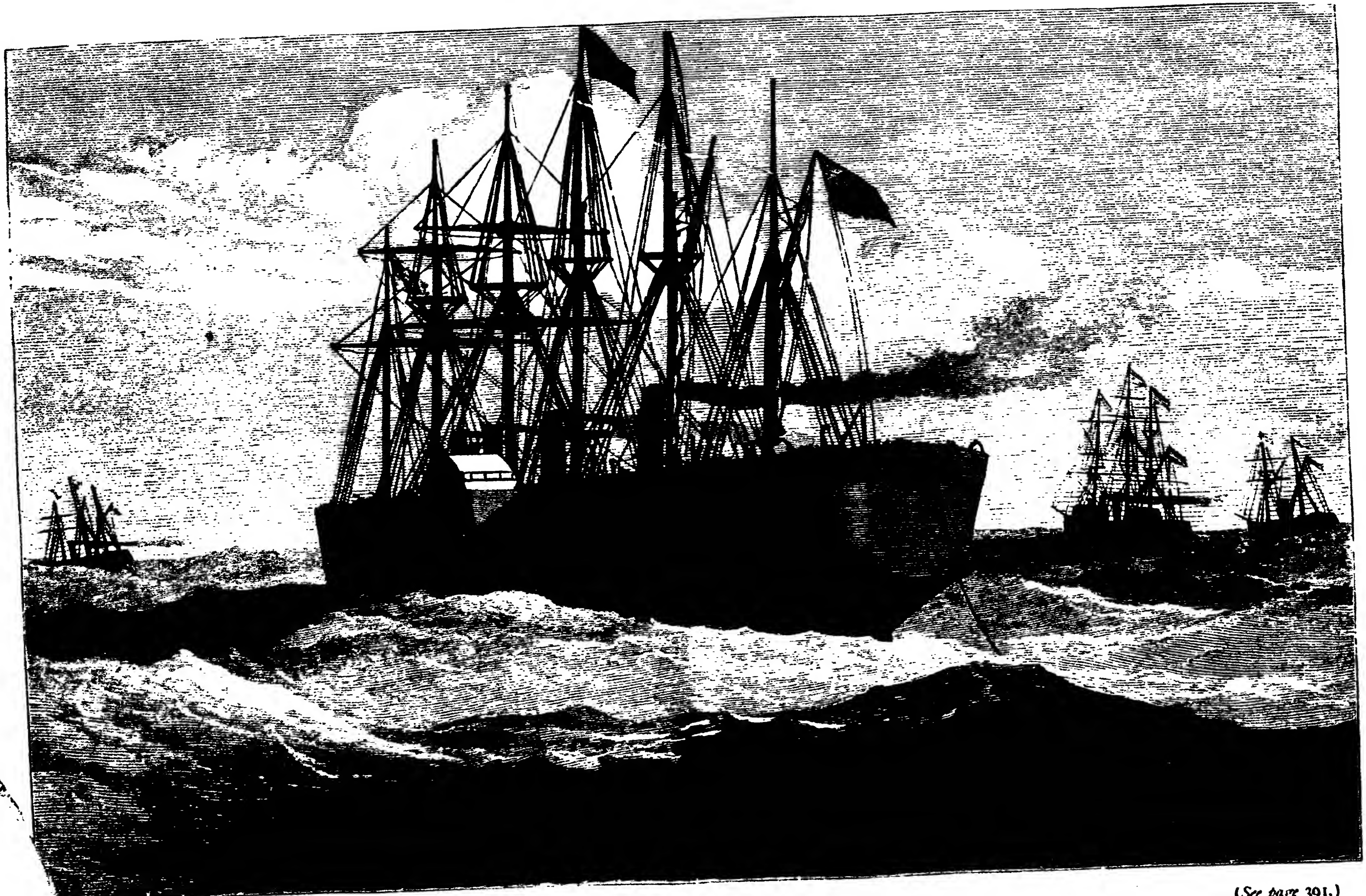
The manner in which the young are fed is very curious. The old bird makes a great noise, between quacking and braying; after having thus chattered for a minute, it puts its head down and opens its mouth widely, into which the young one thrusts its beak and takes the food provided for it.

MEDICINE IN ITALY TWO HUNDRED YEARS AGO.

An old document that has just been discovered in the archives of Ferrara gives a curious illustration of the progress and profession of medicine in the sixteenth century, as well as of the amount of credulity that professors of the healing art were able to count upon among the witnesses of their performances.

It appears that Ferrara was rather famous for its school of medicine, and that accordingly the diplomas it granted were held in very high repute. An Italian named Generoso Marini, apparently a stranger, applied to the college for a degree, but the professors very properly decided that they could not grant his request without testing his knowledge and ability in the science of medicine. Marini upon this offered himself for examination, and the examiners were so satisfied with the result, that they not only granted him the diploma he had applied for, but they made it a record of the wonderful skill which he possessed.

The document itself runs thus:—"Having publicly examined and approved the science and knowledge of medicine of Signor Generoso Marini, and his possession of the wonderful secret called *orvietano*, which he exhibited on the stage built in the centre of the piazza of this our city of Ferrara, in presence of its entire population—so remarkable for their civilisation and learning—and in presence of many foreigners and other classes of people, we hereby certify that also in our presence, as well as that of the city authorities, he took several living toads—not those of his own providing, which might have given suspicion of deception on his part. One of the officials then mounted the platform and selected the five largest of the toads, which the said Generoso Marini placed beside him upon a bench. He then, in the presence of all the spectators, cut each of the toads in two, and, taking a goblet in one hand and half of



LAYING THE ATLANTIC CABLE.

(*See page* 391.)

one of the dead toads in the other, he squeezed from it all the fluids and juices which it contained into the cup, and he did the same with all the others. He then mixed the contents well together and swallowed them all, and laying the empty cup upon the bench, he came to the front of the stage, where for a short time he remained perfectly motionless, his limbs began to tremble, his body became as pale as death, and grew frightfully swollen and distorted, so that all the audience thought he would never recover from the poison he had drank, and that his death was certainly approaching.

"All at once he took from a jar at his side some of his famous *orvietano*, and putting a little of it in his mouth swallowed it down. The effect of this medicine was instantaneous; he began to vomit up the poison he had taken, and he stood before the spectators perfectly restored in his health. The people applauded him tumultuously for this proof of his great talent. He thereupon invited many of ths most learned there present to accompany him to his own house; there he brought them through his dispensary and showed them his collection of many antidotes, and, amongst others, a powder made from little vipers, a most efficacious remedy for the cure of every sort of fever, as he had satisfied himself by different experiments made on people of rank and virtue, whom he had cured from the fevers with which they were afflicted. He also showed a wonderful balsam—his own invention—with which he could cure almost immediately bruises, wounds, burns, and scalds of all kinds."

A STOPPAGE OF THE FALLS OF NIAGARA.

THE following remarkable account of the stoppage of Niagara Falls appeared in the *Niagara Mail* at the time of the occurrence:—"That mysterious personage, the oldest inhabitant, has no recollection of so singular an occurrence as took place at the Falls on the 30th of March, 1847. The 'six hundred and twenty thousand tons of water each minute' nearly ceased to flow, and dwindled away into the appearance of a mere mill-dam. The rapids above the falls disappeared, leaving scarcely enough on the American side to turn a grindstone. Ladies and gentlemen rode in carriages one-third of the way across the river towards the Canada shore, over solid rock as smooth as a kitchen floor. The *Iris* says: 'Table Rock, with some two hundred yards more, was left dry; islands and places where the foot of man never dared to tread have been visited, flags placed upon some, and mementoes brought away. This unexpected event is attempted to be accounted for by an accumulation of ice at the lower extremity of Fort Erie, which formed a sort of dam between Fort Erie

THE ATLANTIC TELEGRAPH.

THE first cable laid between the Old World and the New, short-lived as it had proved, sufficed to show the necessity for a communication of this sort across the Atlantic; and after the most persevering efforts to raise fresh capital, it was determined to make another attempt. The *Great Eastern* steam-vessel, after proving a commercial failure, was now laid up at moorings with every probability of remaining there. Still, she had proved herself a splendid sea-going ship, and her immense carrying capacity pointed to her, and her alone, as *the* ship to lay the future Atlantic cable.

The cable of 1865 consisted of the elements:—A copper conductor, composed of seven No. 18 wires twisted together into a strand, the weight per nautical mile being 300 lb., or 308 tons to complete the whole length, which was 2,300 miles as coiled on board; an insulating wrapper of gutta-percha, laid on in four thin layers, with a compound between each, called Chatterton's Compound, the weight per mile being 400 lb.; a padding of jute yarn, saturated with a preservative compound, wrapped round the gutta-percha; and outside this, ten solid wires, No. 13 gauge, of homogeneous iron, each wire being separately surrounded with Manilla yarn steeped in a preservative compound. The weight of the finished cable was 35 cwt. 3 qrs. per nautical mile in air, and only 14 cwt. in water, showing a very low specific gravity. The cable was calculated to bear a strain of nearly eight tons before breaking, and hence would support eleven miles of itself hanging vertically over a ship's stern. The total weight of deep-sea cable coiled on board the *Great Eastern* in 1865 amounted to 4,111 tons. The diagrams on the next page show the comparative size of the cables. Fig. 1 is a section of the cable of 1858, Fig. 2 is the 1865 cable.

One serious cause of error in carrying out the enterprise of 1857-58 lay in not keeping the cable under water from the moment of its manufacture until its final submergence. It was now, accordingly, determined very rigidly to adhere to this plan.

The enormous tanks which had been excavated at the works, and which were found so faulty as to be useless on the first occasion, had been repaired and were kept filled with water, and into this the new cable was coiled directly it left the covering machine. Similar tanks, three in number, were prepared on board the *Great Eastern*, and the cable coiled into them, the weight of water they contained after the cable had displaced its own bulk of the liquid being 1,198 tons. The great space occupied by this cable may better be realised by giving the sizes of the tanks which were filled by it. One was fifty-eight feet in diameter; another fifty-eight feet six inches; and the third, fifty-one feet six inches; all three being twenty-six feet high.

On the 22nd of July, 1865, the laying of the "shore end" commenced, Ireland being the starting-point. This piece of cable was twenty-seven miles long, and of immense strength, to contend against the violence of the great billows which surge against the rocks that dot this coast, and also to oppose a stout resistance to any chance anchor which some storm-driven ship might let go.

In little more than twelve hours from the landing of the end, the laying of this portion was successfully accomplished. The splice with the smaller or "deep-sea" portion of the cable was speedily effected, and on Sunday evening the 23rd of July, the *Great Eastern* commenced moving westward, laying the cable as she went.

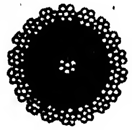


Fig. 1.

It is not necessary to chronicle all the minor mishaps which occurred between this time and the final catastrophe which took place on the 2nd of August. Serious defects were suddenly discovered at various times in the cable, defects which interfered with the transmission of the signals through the wire. Upon one occasion a fault showed itself after it had left the ship and was eleven miles astern; but the ship was stopped, and by slow degrees the eleven miles were hauled in and the fault cut out. With these exceptions everything went on well, the *Great Eastern* proving herself in all respects worthy the confidence which had been placed in her capabilities. The cable went smoothly overboard at an average rate of a little over six knots an hour; the difference between the distance run and the length of cable paid out being about 12·3 per cent.

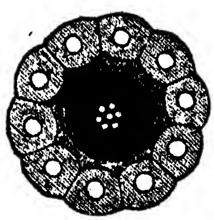


Fig. 2.

Upon the 2nd of August, a slight defect showed itself, and, as upon former occasions, arrangements were made to haul in the cable until the fault was found. Unfortunately, however, the wind had changed, and rendered the handling of the ship more difficult; and, in spite of the most consummate seamanship on the part of her commander, it was impossible to prevent the cable chafing against the vessel's sides. Thus weakened, the cable was unable to bear the strain put upon it, and soon after twelve o'clock, under an indicated strain of about three tons, it parted and dashed into the ocean, carrying with it the bright hopes of many on board. The depth of water at this point was 1,950 fathoms, but it was nevertheless resolved to send down a grapnel with two miles of rope attached to it, and try to *fish* for the lost cable. Three successive attempts were made, and upon each occasion with very little doubt the cable was hooked and brought up a great distance from the bottom; but the tackle, being unable to bear the immense strain, broke. Not until all the tackle had been expended was the attempt to raise the cable abandoned, and then the *Great Eastern* returned to England.

It was now resolved not only to grapple again for the broken cable, and to complete that line to Newfoundland, but actually to lay a second cable. The cable which had been two-thirds laid had alone cost £700,000, and another sum equal to this was now required. The form of the second cable —that of 1866—was in all important points the same as that of the previous year. It weighed slightly less in air and slightly more in water; hence its specific gravity was greater, but this was compensated for by the greater breaking strain—8 tons 2 cwt.

The most successful of all the layings —that of 1866—was, after all, the least eventful. The cable was laid with absolute success, and on the 27th of July a message transmitted through it, from "The Queen, Osborne, to the President of the United States, Washington," inaugurated its success. This message of forty words occupied only twenty-one minutes in transmission—a vast improvement over the speed attained in the cable of 1858.

It now only remained to recover the cable lost in 1865. A year had passed away since the accident, and the buoys which had then been placed over the spot had drifted, perhaps to the North Pole, perhaps to the South. Nothing was left to guide the voyagers to the spot but the observations taken at the time.

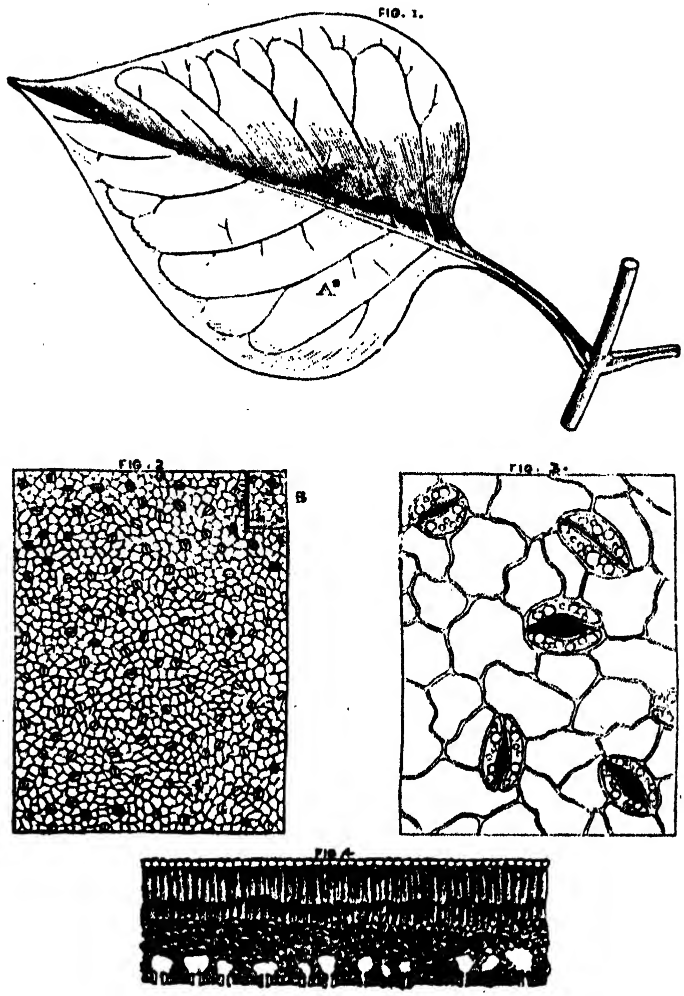
These, however, were ample. The science of navigation could direct them to any particular spot upon the trackless deep. Without delay the *Great Eastern* left the shores of Newfoundland for the calculated spot; and upon the 2nd of September that great and crowning triumph of ocean telegraphy was accomplished, the hooking and fishing up the cable from a depth of two miles of water. It was at once tested and found to be as perfect as when it broke, and within an hour after its recovery, seventeen messages were transmitted through it.

There are now, therefore, two cables in excellent working order crossing the Atlantic, laid at a sufficient distance apart to prevent the same cause interrupting both simultaneously; the wisdom of having so arranged it having been seen upon more than one occasion. An iceberg has twice deranged one of the cables, but there still remained one link of communication unimpaired; and, owing to its excellent condition, one cable is at all times able to convey the work between the two continents. And so accurately is the work performed, that the average quantity of errors is less than 2 per 1,000.

THE FOOD OF PLANTS.

THE food of animals is largely produced by plants. Animals can assimilate only organised substances. Plants live on inorganic substances. They are ever changing inorganic matter into organic for the use of animals.

Plants live upon air and water. The soil into which it buries its roots is not essentially necessary to the plant. Its chief use is in supplying a store of water, and a means of making the plant stable. Many plants never send their roots into the soil, but live on branches of trees, without, however, obtaining their nourishment from the branch like the parasitic mistletoe, but entirely drawing the two elements of their food — the air and water — from the atmosphere. In our own woods such plants are common, but from their small size and insignificant aspect, they do not attract attention. The gay orchids and the feathery ferns of the tropics take the place of our humble lichens and mosses, and, like them, obtain all their food from the moist atmosphere in which they live. Other plants, again, grow in water, without any attachment to the earth, and, also, without pushing their foliage up into the atmosphere. These obtain their necessary supply of air from the small quantity that is dissolved in all waters.



DIAGRAMS ILLUSTRATING THE FOOD OF PLANTS.

The three elements that make up the plant-fabric are carbon, oxygen, and hydrogen. The last two, when chemically combined, form water, and they enter into combination with carbon to form the organised tissue of the plants in the same proportion as they are found in water. It is obvious, then, that the water furnishes these two elements. Every one knows how necessary water is to vegetable life, from observing how speedily a plant dies when its supply of water is exhausted. It drinks in water chiefly by its roots from the soil. It is also absorbed, to some extent, from the atmosphere by the leaves.

The other element in the essential structure of plants is carbon. This is the same substance with charcoal. Wood charcoal, indeed, is the pure carbon after the hydrogen and oxygen has been driven off by fire. Carbon cannot be dissolved in water, but it combines with oxygen and forms a gas called carbonic acid, which is one of the constituents of the atmosphere, making up about a two thousand five-hundredth part of its bulk. This small quantity is sufficient to supply the carbon needed for plant life, but not enough to injure animals, to whom, when breathed in any quantity, it is a deadly poison.

The carbonic acid is taken in by the leaves. They are provided with thousands of minute mouths called stomates, which penetrate the skin of the leaf, and permit the entrance of the atoms of carbonic acid. These stomates are oval openings,

guarded by a pair of thin-walled cells or lips, which have the power of opening or closing according to the requirements of the plant. They are most abundant on the under surface of leaves, being almost confined to them in leaves which are spread out horizontally, and which present their upper surface to the sun, but occurring on both surfaces of erect leaves like those of grasses and sedges. They are very small, but make up for their minuteness by their great numbers. They vary from less than 1,000 to more than 200,000 to the square inch of the surface of the leaf. In the apple tree there are about 24,000 to the square inch, so that each leaf has nearly 100,000 of them. Every inch of the leaf of the hydrangea has no fewer than 160,000 of stomates, so that a single leaf has no less than 1,250,000 of them. The plant we have chosen for illustrating this subject is the common lilac—a moderate-sized leaf of which is represented in Fig. 1. A small portion, $\frac{8}{100}$ths of an inch in length, and $\frac{8}{100}$ths in breadth (A, Fig. 1), has been taken from the under surface, and magnified at Fig. 2. This exhibits 121 stomates—being equal to 200,000 on every square inch, or nearly 700,000 to each leaf. A small portion of Fig. 2 (B) has been still more highly magnified at Fig. 3, where the structure of the stomate can be distinctly seen.

The stomates form openings into cavities in the green, cellular substance of the leaf, and it is in it that the remarkable chemical operation is carried on which converts the air and water into wood and starch. A section of a portion of the lilac leaf magnified to the same extent as Fig. 2 is shown in Fig. 4, in which the relation of the stomates to the cellular cavities is exhibited. The upper surface of the leaf has a dense layer of one or more series of long cells below the skin. These are exposed to the sun, and under the influence of its light the leaves actively carry on their operation of changing the dead matter into their own organised substance. They break up the carbonic acid gas into its two elements of carbon and oxygen, and give off the oxygen needed for the life of the animal kingdom, while they retain the carbon and combine it with the elements of the water to form the fabric of the plant itself.

Leaves are really a beautiful contrivance for increasing the surface of the plant, so as to obtain the largest space exposed to the influence of the sun and the air. In a large tree tier after tier of leaves are thus spread out, so as to produce in the aggregate a very extensive area. The leaves on a good-sized elm tree have been estimated at 7,000,000. They form a surface of no less than 200,000 square feet, or about five acres of foliage! We have, with some care, estimated the number of leaves on a lilac bush, standing about five feet high, and they amount to about 10,000. These would give to such a bush an area of no less than 230 square feet of foliage, and no less than 7,000,000,000 stomates!

THE MASSACRE OF ST. BARTHOLOMEW.

History seems to record no more dreadful example of religious hatred and intolerance than the fearful slaughter that took place in Paris during the month of August, 1572, and which has been known to all succeeding ages as the Massacre of the Huguenots or the Massacre of St. Bartholomew. The French Protestants were assembled in the capital in honour of the marriage of Henry of Navarre with the Princess Margaret, when the fierce queen-mother, Catherine de Medici, aided by the Dukes of Guise, Anjou, and others, prevailed upon the weak young king, Charles IX., to consent to their assassination. The plot was ripened, distinguishing badges issued to the Catholics, and on the eve of St. Bartholomew, at midnight, the bell of the quaint little church of St. Germain de l'Auxerrois tolled forth the knell of 30,000 departing souls. Mercy there was none to be shown, every Huguenot was to be slain; and encouraging each other in their fearful task, the murderers proceeded from house to house, slaying old and young, sparing neither sex. Admiral Coligny, one of the great Protestant leaders, was the first victim; and then taken by surprise, family after family was slaughtered. Here and there a feeble resistance was kept up; but in too many instances the wretched martyrs to their religion were shot or cut down like sheep, in house or street—fleeing from one inimical party to be encountered by another. "Death to the Huguenot! kill! kill!" was the fearful cry that rung through the streets of Paris that night, and through the long day which followed; but towards evening the king sent forth a herald to command a cessation of the carnage. In vain, though; the furious fanatical passion let loose was not so easily controlled, and for the two following days the slaughter was kept up, the opportunity being seized upon by many a wretch to destroy and plunder some enemy. And not only in Paris were these barbarities practised, but in some of the greater cities of the provinces many Huguenots were slain; no steps being taken by the king, or rather by the queen-mother, to arrest the dread scenes. The blame was at first attempted to be laid on the enmity existing between the houses of Guise and Coligny; but afterwards the young king openly averred that the massacre took place at his command, and took to himself the credit of having given peace to France by the sweeping destruction of her Protestant enemies. But the slaughter, even in a political sense, was a grievous error, rousing the indignation of Europe, and remaining a fearful reproach against the French Catholics; while the king's short span of life terminated two years after—a life of misery and suffering, mental and bodily, remorse being his portion for the part he had allowed himself to be forced into in connection with this fearful massacre.

THE INVISIBLE GIRL.

THE invention of this curious piece of mechanism may be considered an improvement on the oracular responses of the dark ages. This very ingenious apparatus was publicly exhibited both at Bristol and in London for a considerable period, during which time no discovery was made of its internal mechanism; and it is probable that its construction would have remained a secret to all but the exhibitors, but for the ingenuity of Mr. Millington, who in the course of lectures delivered in the winter of 1806, explained the manner in which it was performed.

The *visible* part of the apparatus connected with the *Invisible Girl* was thus constructed. First, a mahogany frame, resembling a bedstead, having at the corners four upright posts about five feet high, was united by a cross-rail near the top, and two or more cross-rails near the bottom, to strengthen the frame, which was about four feet square. The frame thus constructed was placed upon the floor, and to the top of each of the four pillars were attached so many strong, bent wires, converging towards the top, where they were secured by a crown and other ornaments. From these wires a hollow copper ball was suspended by slight ribbons, so as to cut off all possible communication with the frame. The globe thus supported was supposed to contain the invisible being, as the voice apparently proceeded from the centre of it; and for the purpose it was equipped with four trumpets, placed round it in a horizontal direction, and at right angles to each other—the trumpet mouths coming to within about half an inch of the respective cross-rails of the frame surrounding them.

When a question was proposed, it was asked from one side of the frame, and spoken into one of the trumpets, and an answer immediately proceeded from the whole of them, so loud as to be distinctly heard by the inquirer, and yet so distant and feeble that it appeared as if coming from a very diminutive being. Hence the sound was supposed to come from an invisible *girl*, though the real speaker was a full-grown woman. In this the whole of the artifice consisted; and the variations were so contrived that the answer might be returned in several languages; a kiss might be returned; the breath producing the voice was felt; and songs were sung, accompanied by the pianoforte. She also conversed in different languages, and made lively and appropriate remarks on persons in the room. To produce this illusion, the sound was conveyed by a tube, in a manner similar to the old and well-known contrivance of the Speaking Bust; the Invisible Girl only differing in one circumstance—that an artificial echo was produced by means of the trumpets and hollow globe, in consequence of which the sound completely reversed.

In the construction of the Invisible Girl, the orifice of the tube was in one of the hand-rails, opposite the mouth of one of the trumpets, the opening being concealed by reeds and other mouldings. The tube itself, which was about half an inch in diameter, ran through half the hand-rail, then down one of the corner posts, and from thence under the floor till it reached a large deal case—almost similar to an inverted funnel—along the side of which it rose till it came nearly into contact with the ear of the confidante, who, with a pianoforte, &c., was concealed in the case. Any question asked by a voice directed into one of the trumpets was necessarily reflected back from the concave interior surface of the globe to the orifice of the tube, along which it was conveyed so as to be distinctly heard by the person in the deal case, who returned the requisite answer, which appeared to come precisely from the interior of the globe. A small hole closed with glass was likewise left through the deal case and wall of the apartment, by means of which the concealed person had an opportunity of observing what was going on in the exhibition room; and communications were no doubt made to her by signals from the person who attended the machine.

The surprise of the auditors was greatly increased by the circumstance that an answer was returned to questions put in a whisper; and also by the conviction that nobody but a person in the middle of the audience could observe the circumstances to which the invisible figure frequently adverted.

The Invisible Girl was reproduced as an exhibition in 1839, at the Gallery of Practical Science, in Adelaide Street, Strand.

TALKING BIRDS.

THE variety of strange sounds uttered by various birds has been duly noted by ornithologists and bird-fanciers. Some are more teachable than others, and it is to these specimens that the epithet of "talking" is strictly applicable. We

> "Argue not with Jacques Rousseau,
> If birds confabulate or no."

The bullfinch, according to Blumenbach, learns to whistle tunes, to sing in parts, and even pronounce words. In the year 1858, Mr. Leigh Sotherby, in a letter to Dr. Gray, of the British Museum, describes a talking canary. Its parents had formerly successfully reared many young ones, but three years previously they had hatched only *one* out of four eggs, which they immediately neglected by commencing the rebuilding of a nest upon the top of it. On this being discovered the unfledged and forsaken bird, all but dead, was taken away and placed in flannel by the fire, when, after much attention, it was restored and then brought up by hand. Thus treated, and away from all other birds, it became familiarised with

those persons only who fed it; consequently its first singing notes were of a character totally different to those usual with the canary. Constantly being talked to, the bird, when about three months old, astonished its mistress by repeating the endearing terms used in talking to it, such as "Kissie, kissie," with its significant sounds. This went on, and from time to time, the bird repeated other words, and for hours together, except during the moulting season, it astonished all who heard it by ringing the changes according to its own fancy, and as plainly as any human voice could articulate them, on several words. The usual singing notes of the bird were more of the character of the nightingale, mingled occasionally with the sound of the dog-whistle used about the house. It whistled also very clearly the first bar of "God save the Queen."

Several birds approach the faculty of talking, mimicry, and imitation of peculiar sounds. The Chinese starling, in captivity, is very teachable, imitating words and even whistling tunes. The piping crow is named from its ready mimicry of other birds; and its imitation of the chuckling and cackling of a hen, and the crowing of a cock, is very perfect. Mr. Wallace saw, on the Amazon river, a bird with a loud, hoarse cry, whence it is called the trumpet-bird; and the crowned crane has a similar note. The greater-billed butcher-bird of Australia imitates the notes of some other birds, and thus decoys them to their destruction. The laughing goose is named from its note having some resemblance to the laugh of man. The snowy-owl utters hideous cries, which resemble those of a man in deep distress. The natural cry of the Virginian eagle-owl resembles the half-suppressed screams of a person being suffocated or throttled.

Parrots have presented remarkable instances of *talking*. Among the many that have been imported into this country, the one whose imitative talent was reckoned most extraordinary belonged to Dennis O'Kelly, commonly called Count O'Kelly, which he purchased in 1772, some say for fifty, others 100 guineas, out of a West India ship at Bristol. This bird not only repeated a great number of sentences, and answered questions, but was able to whistle, with the greatest clearness and precision, the 104th psalm, "The banks of Dee," "God save the King," and some other favourite songs, and if by chance it mistook a note, it would revert to the bar where the mistake occurred, and finish the air with great accuracy. This bird had received a refined education, and its breeding and bearing were clearly that of a polished bird of rank. O'Kelly died in 1787; his wonderful parrot, left in the custody of his widow, survived its master for fifteen years, and died at a good old age at the colonel's late residence, in Half Moon Street, Piccadilly, in 1802, having been in the family for thirty years. It is stated that the colonel was repeatedly offered 500 guineas per annum by persons who wished to make a public exhibition of the bird; but this, out of tenderness to the favourite, he continually refused. The body was dissected, when the muscles of the larynx, which form the voice, were found, from the effects of practice, to be uncommonly strong; but there was no apparent cause for the sudden death of the bird.

THE COLD OF CANADA.

SIR FRANCIS HEAD gives the following description of the intense cold which in winter characterises the climate of Canada:—

"The cold of the Canada winter must be felt to be imagined, and when felt can no more be described by words, than colours to a blind man or music to a deaf one. Even under bright sunshine, and in a most exhilarating air, the biting effect of the cold upon the portion of our face that is exposed to it resembles the application of a strong acid; and the healthy grin which the countenance assumes requires—as I often observed on those who for many minutes had been in a warm room waiting to see me—a considerable time to relax. In a calm almost any degree of cold is bearable, but the application of successive doses of it to the face by wind becomes occasionally almost unbearable. Indeed, I remember seeing the left cheek of nearly twenty of our soldiers simultaneously frost-bitten in marching about a hundred yards across a bleak, open space, completely exposed to a strong and bitterly cold north-west wind that was blowing upon us all.

"The remedy for this intense cold, to which many Canadians and others have occasionally recourse, is—at least to my feelings it always appeared—infinitely worse than the disease. On entering, for instance, the small parlour of a little inn, a number of strong, able-bodied fellows are discovered holding their hands a few inches before their faces, and sitting in silence immediately in front of a stove of such excruciating power that it really feels as if it would roast the very eyes in their sockets; and yet, as one endures this agony, the back part is as cold as if it belonged to what is called at home 'Old Father Christmas.'

"As a further instance of the climate, I may add that several times, while my mind was very warmly occupied in writing my despatches, I found my pen full of a lump of stuff that appeared to be honey, but which proved to be frozen ink. Again, after washing in the morning, when I took up some money that had lain all night on my table, I at first fancied it had become sticky, until I discovered that the sensation was caused by its freezing to my fingers, which, in consequence of my ablutions were not perfectly dry."

SEA PORCUPINES.

Below is a drawing of one of the family of *Balistes*, a race of fishes chiefly inhabiting tropical waters. They are eminently noticeable objects, if for nothing else, for the horns they carry, and for the numerous horny spines with which their bodies are studded. There is one family of them which has teeth arranged in the jaw like those of human beings, but with air direct from the *æsophagus*. This power of distension, forcing the fish into a large globular form, furnishes a formidable means of repelling attack. The body being so blown out, the spines stand forth stiff and bayonet-like, and present a sort of *chevaux de frise*, before which many an enemy quails. When distended, the fish floats belly upwards, and looks one of the most helpless things imaginable. Mr. Darwin met one on the

SEA PORCUPINE.

the special class now under notice has, in lieu of fangs, a horny covering to its lips and palate enabling it with special facility to grind the sea-weeds, crustaceans, and small molluscs, upon which it is thought to feed. The colour varies in different sub-genera. The commonest is black on the back and on the greater part of the body, with yellowish belly, the horny spines, both distinct and associated as fins, being of the latter hue. Some of the fish have a large air-bladder in the belly, which they can inflate at will. The bladder extends over the belly underneath the skin, and is supplied coast of Brazil which was able to bite very severely, and to throw water from its mouth to a considerable distance. Darwin adds "that it emitted from the skin of its belly, when handled, a most beautiful carmine-red secretion, which stained ivory and paper in so curious a manner that the tint is retained with all its brightness to the present day." Some of these fishes are known as sea porcupines, and a few are taken occasionally on the south-western coasts of England. Their flesh, however, is worthless. They are valuable only as curiosities.

Scientific Curiosities.

Dangers of Chemical Experiments.—M. Rouelle, an eminent French chemist, was not the most cautious of operators. One day, while performing some experiments, he observed to his auditors, "Gentlemen, you see this cauldron upon this brazier; well, if I were to cease stirring a single moment, an explosion would ensue which would blow us all in the air!" The company had scarcely time to reflect upon this comfortable piece of intelligence before the operator did forget to stir his mixture, and his prediction was accomplished. The explosion took place with a terrible crash; all the windows of the laboratory were smashed to pieces, and two hundred auditors thrown about the building and out of it in confusion. Fortunately none received any very serious injury, the greatest violence of the explosion having been in the direction of the chimney, and the demonstrator escaped without further harm than the loss of his wig.

The Dew-fall of a Year.—The annual average quantity of dew deposited in this country is estimated at a depth of about five inches, being about one-seventh of the mean quantity of moisture supposed to be received from the atmosphere all over Great Britain in the year; or about 22,161,337,355 tons, taking the ton at 252 imperial gallons.—*Wells on*

Life-preserving Apparatus for enabling an exploring party to carry with them an adequate supply of oxygen gas, or vital air, has been invented by M. Rouquayrol. It consists of a vessel of sheet-iron, capable of resisting the pressure of from twenty-five to forty atmospheres. Air is forced into it by pumps, of which the pistons are fixed, and the cylinders movable. The apparatus is fastened on the back like a soldier's knapsack. A bellows-like contrivance is placed above the vessel or reservoir, which allows the air, though so greatly compressed, to enter the lungs at the ordinary pressure of the atmosphere. A small external valve, formed of two leaves of India-rubber, which are kept in contact with each other by the pressure of the atmosphere, opens to allow the expired air to escape. It is asserted that a man thus provided can breathe with ease under water, as proved by experiments on rivers, and at the bottom of the sea.

Human Electricity.—Sir John Richardson, in his "Boat Voyage through Rupert's Land," vol. ii., p. 101, states that in the cold latitudes the body becomes visibly electric from the dryness of the skin. One cold night, on going out to observe the thermometer, having only a flannel night-dress on, a *distinct spark* was elicited when his hand approached the iron latch of the door.

THE WONDERS OF POISON.

The mysterious power by which life is sustained is only to be equalled, in point of interest, by the numerous materials which exist in every department of nature capable of destroying it. The atmosphere has its gases and floating germs, which oftentimes produce disease and cause death. The same poison which drove the first settlers from the Palatine Mounts, has given its fevers and agues to inhabitants of various parts of the globe—from the ditches of Holland to the dense jungles and low swamps of the tropics. And the land of Tusculum, in bygone ages, witnessed death from pestilential effluvia, as the banks of the Ganges do now.

That subtle agent of death, carbonic acid, issues from the lungs of the healthy human being at the rate of 1,393 cubic inches per hour, as if contending for the palm with the stream, which Johnston tells us "rushes as if from subterranean bellows, on the table-land of Padeborn; astonishes travellers in the Grotto del Cane; interests the chemical geologists in the caves of Pyrmont, and among the old lavas of the Eifel; and is terrible to man and beast in the fatal Valley of Death, the most wonderful of the wonders of Java."

The vegetable world has, pervading some of its beautiful members, insidious juices which, when taken into the system, speedily cause death. The earth has embedded in its strata substances equally as destructive to life; while Nature has armed several species of the animal kingdom—creeping, walking, and flying—with poison-darts of a formidable nature as instruments of defence, which can seriously affect the natural progress of life, and in many instances prove fatal to its continuance. Poison exists everywhere, and lack of knowledge of the insidious enemy often proves a source of death. Poisonous fungi have been mistaken for edible ones; aconite root for horse-radish; fools' parsley for common parsley; while many of those agents which man has artificially prepared to alleviate suffering, and ward off the attacks of disease—in the hands of the careless, the ignorant, and the vicious—have oftentimes proved a terrible source of death.

Poisons may be introduced into the system, by swallowing, by the breath, through the medium of the lungs, and from the surface of the body.

Claude Bernard has shown that the more active poisons destroy life, by attacking particular organs or tissues, essential to it. Thus the wourali poison paralyses the motor nerves; strychnia attacks the sensitive portion of the nervous system, and excites fatal reflex action; while digitalis, veratria, and several other poisons, act on the muscular tissue throughout the body.

Different effects are oftentimes produced by the on man and

Beck asserts, that sweet almonds kill dogs, foxes, and fowls, while aloes are destructive to dogs and foxes, pepper to hogs, and parsley to the parrot. The influence of the same poison on different individuals, is indeed wonderful. Some are as peculiarly susceptible to their action as others are callous to them. Many people cannot take opium, others are severely affected by the smallest doses of mercury, and Epsom salts even has been known to produce alarming symptoms of irritant poisoning.

Of animal poisons—in this country—during the winter months, we have few or none; and summer's heat brings with it nothing worse than the sting of a wasp or bee, or the bite of a viper. But the inhabitants of warmer climates are troubled with a legion of mischievous and death-dealing creatures.

The hornet is one of the most venomous insects found in this country, though, as a rule, the sting of either the hornet, bee, or wasp do not cause much inconvenience. Instances have, however, been known where great fever and constitutional disturbance have been set up by them. Bees have proved more formidable in an indirect than direct way; viz., from gathering honey from the flowers of poisonous plants. Xenophon tells us, that during the retreat of the ten thousand, a number of Greek soldiers were violently affected by honey which they had eaten near Trebizond. In 1834 a specimen of this honey, which still retains its poisonous qualities, was sent to the Zoological Society. In 1790 an extensive mortality was produced amongst those who had partaken of honey collected in the neighbourhood of Philadelphia. It was afterwards ascertained that the honey had been chiefly collected from the flowers of *Kalmia latifolia*.

The *scorpion* is one of the most venomous insects in southern countries. Its sting causes great local inflammation, with more or less fever, trembling, and pain. Orfila states that animals sometimes die from the effects of the scorpion's sting.

The bite of the common viper rarely proves fatal to human life, though its venom is sufficiently powerful to kill the lower animals. The Abbé Fontana, who investigated this poison in every possible point of view, found it harmless when swallowed. It is a yellowish, viscous liquid, neither acid nor alkaline, and without definite taste. The bite of the viper is not hurtful to another viper, or to cold-blooded animals, as leeches and frogs.

The bite of the cobra di capello is exceedingly dangerous, and rapidly proves fatal. In 1852 a keeper at the Zoological Gardens was bitten on the nose by a cobra, and died in ninety-five minutes. There was no swelling, though there was a slightly pinkish hue of the eye-lids, difficulty of breathing, stupor, paralysis of the limbs, and speedy coma. The chief *post mortem* appearances were a dark, fluid state of the blood, which emitted a sour and sickly smell, and intense congestion of the internal organs.

The bite of the rattlesnake is also rapidly fatal. Sir Everard Home mentions a case of a man accidently bitten twice in the hand by a rattlesnake, kept for the purpose of exhibition in London. He died eighteen days after being bitten.

Besides the fore-mentioned, there are other animal poisons. The rabid dog, excited either to intense ferocity, or unusual docility, by the virulence of the poison circulating through his system, can communicate this disease, known as hydrophobia, to man and other animals; and, dumb with madness and thirst, longs in vain for one drop of water to cool his parched throat.

The horse also, under certain conditions, becomes affected with two diseases, known as glanders and farcy, both of which are communicable to man. In 1840, in St. Bartholomew's Hospital, a man died of glanders. The nurse who attended him inoculated her hand, and died also in a few days. Two kittens inoculated from the nurse, became likewise affected. Bites received in personal combats between human individuals have been known to exhibit every symptom of poison. The saliva and tartar of the teeth are mentioned as the deleterious substances in these cases.

Many cases are on record proving the poisonous nature of various species of fishes. Some are constantly poisonous; others only occasionally so. The conger eel, yellow-billed sprat, land crab, mackerel, oysters, mussels, &c., are amongst those enumerated. The latter (mussels) not unfrequently produce severe symptoms, such as violent oppression and agony; swelling of the face; a scarlet efflorescence over the body; insatiable thirst and vomiting. In fatal cases there is coldness of the extremities, delirium, hiccup, and, occasionally, coma. The treatment of poisoning in such cases mainly consists in the free use of emetics and purgatives.

Diseased meat and dissecting wounds are also productive of fatal results. The most speedily fatal case on record, from a dissecting wound, is that of a gentleman who died forty hours after the receipt of the injury. Not unfrequently severe symptoms arise from inhaling the effluvia which results from the decomposition of the body, and in certain instances will give origin in others to the same disease which proved fatal to the subject.

Wonders of Vegetation.

THE BANYAN.

Fig trees abound in tropical and sub-tropical regions, often forming large forests, and frequently planted in the neighbourhood of towns and by waysides because of their prodigious crown of foliage. Travellers say that the colossal wild fig trees are

among the most grateful presents of Nature to hot countries; the shade of their magnificent head refreshing the traveller when he reposes under their wonderfully wide-spreading branches and dark, green, shining foliage.

The most remarkable species is the banyan—the *Ficus Indica* of botanists, which is shown in the accompanying illustration. In its early state the banyan resembles other trees in having a single trunk of variable size, and a dense head of foliage. The branches spread out horizontally to so great an extent that they would be unable to support themselves simply by their attachment to the parent stem. To supply the necessary support the branches congregate in great numbers beneath their branches. The public meetings and merry-makings of the villagers are held under their grateful shade.

The leaves of the banyan are of an elliptical cordate shape, about six inches long. They are used by the Brahmins as plates for their meat. The wood is light, white, and porous. The fruit, which grows on the smaller twigs, has no stem; when ripe it has the size and colour of a middle-sized red cherry. It is eaten by monkeys, paroquets and other birds, but is insipid, and therefore seldom made use of by natives, and never by Europeans, as an article of food. The seeds are said to grow the better after having been picked by birds.

THE BANYAN TREE.

throw out here and there small fibrous shoots towards the ground. On reaching the ground they take root, gradually increase in size, and become stable supports for the parent bough, and even rival the original trunk itself. A fresh start is taken from these secondary stems, and the lateral branches continue to throw out new shoots until the plant attains an extent which is almost incredible, and alone forms in time a considerable forest. The height of the tree is at the same time slowly increasing. Dr. Roxburgh has seen single trees which were fully 500 yards in circumference round the extremities of the branches, and about 100 feet high. The principal trunks were twenty-five feet to the first branches, and had a diameter of eight or nine feet. They are largest about the villages in India which are situated in fertile valleys among the mountains. They daily afford shelter to man and cattle, to pilgrims and travellers, who at times

Birds scatter them in the most curious places, sometimes in the angles between the leaves and stem of the Palmyra palm, where they grow, sending down their stem, so as embrace entirely the palm, except its crown of feathery leaves, and giving the palm the appearance of growing out of the trunk of the banyan. Such a combination forms an object of religious veneration to the Hindoos, who call it a holy marriage instituted by Providence.

The banyan is generally supposed to be the only fig whose branches send down supporting stems into the earth. Recently another species has been found in one of the islands of the New Hebrides Group which has the same habit. Its leaves are very small, scarcely an inch long. One tree, described by its discoverer, was 100 feet high, forty-five feet around the trunk, and its branches covered a space 260 feet in diameter. The natives built their houses under its shade.

THE DRAGON TREE OF OROTAVA.

ON the way from Porto Santo to the summit of the Peak of Teneriffe, is situated the considerable town of Orotava. It is now of little importance compared with the towns on the coast, and indeed it is best known as the summer retreat for the wealthier inhabitants of Porto Santo, being about 6,000 feet above the level of the sea. It was formerly the capital and court of the principal kingdom of the Guanches. It is everywhere known as the place where, until 1867, grew the famous dragon tree celebrated for its great antiquity. Humboldt considered it to have been 5,000 or 6,000 years old. Sir John Herschel supposed it to be the oldest tree in the world. Other writers make it so old as to have witnessed some of the last revolutions which the surface of the planet underwent previous to the advent of man.

Its immense hollow trunk was used centuries ago as a temple by the Guanches. The victorious Portuguese, finding it suited for this purpose, dedicated it in the beginning of the fifteenth century to Christian worship. It subsequently suffered greatly from natural causes, as well as from the ruthless vandalism of travellers and curiosity hunters. In the beginning of the present century it lost an immense arm, and decay was rapidly telling upon it when it fell into the hands of its proprietor, who did all he could to preserve this patriarch of the vegetable world. A terrible hurricane which swept over this part of the island in the autumn of 1867, threw it down and completely destroyed it.

In our plate the artist has given a portrait of this famous tree from a photograph taken by Professor Smyth in 1856, as well as specimens of many other trees in various stages of growth. These have been grouped together so as to convey through the eye a large amount of information regarding the dragon tree, and without respect to what were the position and surroundings of the great tree itself, which grew in a garden in the town associated with plants and trees of different aspects and affinities.

GROUP OF DRAGON TREES IN DIFFERENT STAGES OF GROWTH.

The youngest trees in the plate consist of simple stems, of equal diameter throughout, marked with transverse scars produced by the bases of the former leaves, and terminating in a round head of radiating, sedge-shaped, stiff leaves. For twenty years or so from its springing from the seed, the dragon tree retains this appearance, growing only in height. It then flowers, and after flowering, a whorl of three or more branches is produced, each repeating the appearance and passing through the history of the original stem. This now increases in size, the external transverse markings disappear, and a rough, irregular outer surface is formed with numerous perpendicular fissures and scars. Another period of flowering arrives—for another twenty

years the tree has been simply vegetating and preparing nourishment for the vigorous production of flowers and fruit—and now every branch bears its clusters of flowers, which are in time changed into glistening vermilion berries. Then each branch produces a whorl of branches, and by the numerous vascular bundles which it sends down towards the ground, and on the outside of the old stem, greatly increases it in size. The history of the historical tree of Orotava was similar, only repeated an infinity of times. Each new whorl of branches sends down a living woody envelope, which surrounds the older trunk, and this inner trunk by-and-by decays, forming a large chamber in old trees.

A WONDERFUL LAWSUIT.

In the year 1545, a vast number of caterpillars appeared in the vineyards of St. Julien, in Savoy, close to the city of Mauriennc, where the bishop of the locality resided. The caterpillars were called verpillons, and they did frightful damage to the owners of the vineyards, but not to the lawyers and great dignitaries. It seems hardly credible, but an action for damages was brought against the caterpillars. At first the case was referred to arbitration. But as this came to nothing, the matter was in due course brought before the official or ecclesiastical judge of St. Jean de Maurienne. The heads of the villages, who were the plaintiffs, had to appear by counsel, and two brothers, learned in the law, acted for the defendants—the caterpillars. First letters admonishing the caterpillars and their lawyers were sent out, and then a commission was appointed to go and find out the exact amount of damage done, and calculate the amount in coin. When this was done, a discussion arose whether the inspection of the vineyards was proper and legal. Nevertheless, the judge gave his opinion, that not too much haste should be used in proceeding against the caterpillars, as they may have been sent as a scourge. However, the farmers had to pay the bill, and to submit to the caterpillars, for the trial began in 1545, and ended in May, 1546.

In 1587, the caterpillars appeared again, and the plaintiffs—the farmers—promised if the caterpillars should be excommunicated, or put under interdict, that they would find them a place where they would have sufficient food for the future. The judge ordered the plaintiffs to repent of their sins, to pay their tithes, and to walk three days in succession around the vineyards.

This was done, and the fees were paid. But the matter did not end here, for the lawyers for the defendants—the caterpillars—protested, and one named Peter Rembaud, expressed his astonishment at the proceedings against his clients, the most innocent creatures in the world. He said that common sense tells us that brute beasts like the verpillons, cannot be regularly summoned before a magistrate; and he proved from Scripture, that vegetables—and, therefore, vines—are the food of beasts as well as men. Consequently, these poor insects had only used a legal right when they devoured the plaintiffs' vines. He prayed that the case should be dismissed, and the farmers charged with costs. Plaintiffs asked for time to answer, and proved within a month, that insects were created for the use of man. The affair was compromised by the farmers finding a piece of waste land where the caterpillars might go if they liked.

On December the 20th, 1587, the farmers had to pay the costs of the action, as the caterpillars had no goods. The law was cheap in those days, which is wonderful, and the farmers had plenty of it for their money, which amounted to nineteen florins. These extraordinary lawsuits against insects, seem to have commenced about the eleventh century, and as late as 1731, there was a council called in the town of Thonon, to consider the propriety of joining the surrounding parishes in petitioning the pope to excommunicate some insects, and to agree to pay something towards the rate

HUMAN SPIDERS.

BURKE AND HARE.

To enumerate the horrors perpetrated by these two wretches, would be a task verging upon the impossible. Let it suffice that when brought to trial in 1828, Burke confessed to having, with the aid of his accomplice, Hare, and their wives, committed during six months of that year no less than sixteen murders. The scene of their operations was the Old Town, Edinburgh, though they were both Irish. Their trade was to supply the medical men of the Scottish capital with bodies for anatomisation; and finding that there was often a difficulty in the way of procuring the dead, they made no scruple of killing people, whom they decoyed to their lodgings; the prices obtained from the doctors being ten pounds in winter, eight in summer. Their mode of operation was to watch for some one little known or cared for—a beggar, a woman of loose character, or a person whose relatives were at a distance—to make friends, invite the victim to their lodgings in one of the flats of the large houses in the thronging town, and there, plying the poor wretch with strong whiskey, till the scene assumed the character of a drunken revel, to throw him or her upon the bed, and suffocation did the rest. Their first murder was that of a woman enticed into lodging with them: she was suffocated, the body placed in a box, and carried by a porter to a surgeon. Another lodger followed, at a time when the

was empty, the man lying ill of a supposed infectious complaint. He shared the same fate. Upon another occasion, Burke met a constable leading a drunken woman to the station-house, when, by a little persuasion, he induced the man to let him see the poor creature home, and then taking her to his confederates, they disposed of the woman in the same manner. Success seems to have emboldened them, for even with lodgers in the same house, the fearful traffic was carried on; at first removing the bodies by night only, the wretches soon got daring enough to call in porters to carry them away in open daylight, crammed with straw in trunk, tea-chest, or herring-barrel.

The murders were sometimes of the most revolting character, and nothing can be more surprising than the wretches' long immunity from detection, carrying on their trade as they did in the most reckless manner. Upon one occasion, a fearful struggle took place in Hare's room, where a half-witted lad had been decoyed by Mrs. Hare. As was their custom, strong whiskey was forced upon the victim, and then, as he lay on the bed, the murder was attempted; but not accomplished upon this occasion without a desperate encounter. This took place about nine in the morning. At noon the body was being borne to the surgeon's. Among others who followed, were a poor Irishwoman and her deaf and dumb grandchild. The woman, delighted with the hospitality accorded to her, soon became torpid from intoxication, and soon after dead. The next morning the child was murdered, the bodies placed in a barrel, and a fish-cart used for the purpose of conveying the barrel to Surgeons' Square; but, as if knowing the horrible load he bore, the horse refused to draw it, and the barrel had to be conveyed by a porter to its destination. Upon another occasion, they were very near detection, some boys following a load they were bearing in open daylight, and declaring it to be a corpse.

But at last the immunity was at an end; the wretches had reached the extreme end of their crimes. According to their custom, a poor woman was decoyed to the house, and a drunken frolic with singing and dancing commenced, which was kept up hour after hour, the little beggar woman to whom all were so kind, being amongst the merriest. But about midnight, some lodgers in the house were awakened by a noise of uggling, and an outcry as of one being strar d. One lodger roused another, and the more curious applying their eyes to the key-hole of the room whence the noise proceeded, Mrs. Burke was seen holding a whiskey-bottle to the poor woman's mouth. Cries of murder then arose, and one went for the police, but without finding them. There was peace, however, soon; the lodgers retired to rest, considering it to have been a drunken quarrel. But the next morning suspicions were aroused, the police called in, the room searched, and nothing found. But a lodger declared that he had seen a body there, and it was traced to a dissecting-room, identified, and the result was, that the murderers were arrested.

Burke expiated his crimes in the presence of an infuriated mob. Hare escaping the penalties of the law, was on more than one occasion nearly torn to pieces by angry crowds; but making his escape to London, he worked for some time at a tanner's, till being found out, he was thrown by his enraged fellow-workmen amongst some lime, and lost his sight, dying afterwards, it is said, in Canada.

Not one tithe of the horrors perpetrated by these wretches have here been enumerated, but sufficient to excite the wonder of the reader, that at so late a period, and in the heart of a great town, such murders could have gone on so long undiscovered. Upon the subject of the reckless manner in which the bodies were received, it is, perhaps, as well to say nothing, since a bill was introduced into Parliament the following year, for the purpose of sweeping away so great an abuse.

Wonders of Engineering.

STEAM-BUILDING.—An ingenious foreigner visited England about 1825, published an estin of the mechanical force set in action by the steam-engines of this country. He supposed that the Great Pyramid of Egypt required for its erection the labour of more than 10,000 men for twenty years; but if it were required again to raise the same stones from the quarries, and place them again at their present height, the action of the steam-engines of England—which were then managed at most by 36,000 men, would be cient to produce the same effect in eighteen hours.—*Partington's Notes to the "Century of Inventions."*

PROGRESS OF RAILWAYS.—In 1630, Master Beaumont laid down *wooden* rails from his coal-pits, near Newcastle, to the river-side. In 1738, *iron* rails were first laid down at Whitehaven. In 1789, Jessop introduced at Loughborough the cast-iron edge-rails, and flanches cast upon the tires of the wheels, so as to keep them in the track. In 1800, at Little Eton, Derbyshire, Outram used st From his name is derived the term "tramways." In 1802, Trevethick invented and patented his railway locomotive. In 1812, Blenkinsop's engine worked at Leeds, drawing thirty-three coal-wagons at the rate of three and three-quarter miles per hour. In 1815, George Stephenson constructed his locomotive; and, in 1816, he invented a new rail and chair. On the 27th of September, 1825, the railway from Stockton to Darlington was opened for

from Smiles' "Life of

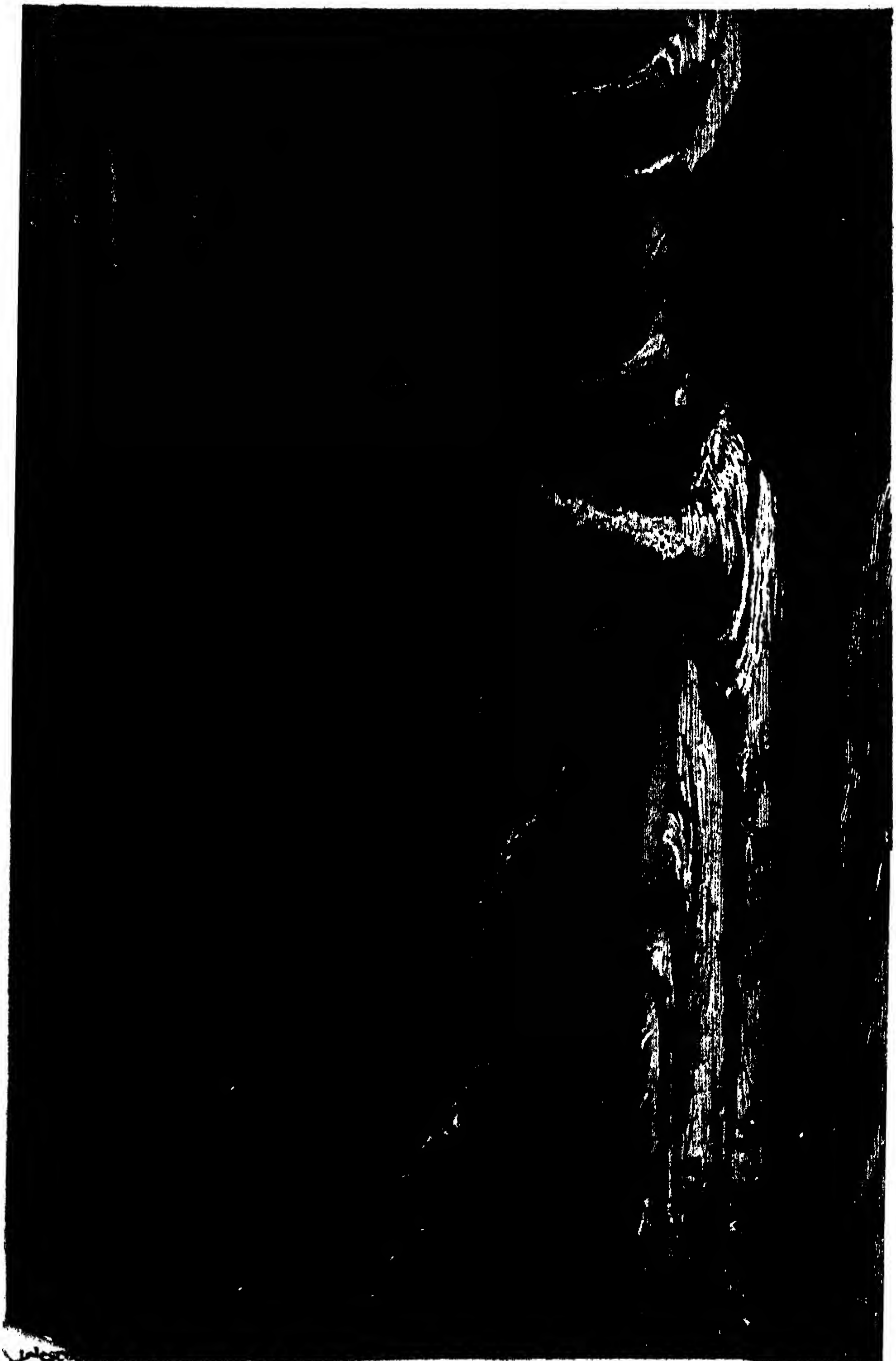
THE SAHARA.

is a vast extent of land in Northern Africa where the surface is composed of fine sand, or of solid and bare rock. In a few favoured localities there are fertile spots where the date-palm surrounded by a stunted underwood and grass; and scattered here and there are places where a scanty vegetation exists after a season of unusual rainfall. Most of this great desert never receives the dew by night, nor rain by day, and the western part of it is almost uninhabited, even by beasts. There are no rivers or brooks, and the intense heat produced by a glaring sun acting upon an arid is succeeded at night by great cold. the east, where the desert becomes moun- i, there are sheltered spots where vegetation flourishes during the rains, which are never abundant. The Atlantic Ocean bounds the desert on the west; and the expanse of sand and rock, with its rare patches of grass and date trees, i eastwards to the river Nile, and measures 2,650 miles in length. The Nile is the eastern boundary, and the northern is formed by the Mediterranean Sea, in some places by Egypt, and by the mountains which form the highlands of Algeria, and which, as they pass westwards, con- the chain of the Atlas. The south of the is very little known. To the west the river Senegal, and some fertile places and hills close to it, form the southern boundary; and further to the east is the town of Timbuctoo, and then a large lake, called Lake Tchad. The traveller who proposes to cross the desert from the high hills of Algeria to Timbuctoo, has to make up his mind to face nearly 1,000 miles of hot, dry, waterless country, where there is hardly a trace of vegetation—where life appears to struggle against nature at a fearful disadvantage, and where some of the most wonderful and stupendous natural phenomena are to be witnessed. This desert is called the Sahara, or and the Sahel is the worst and western part. The Libyan desert is the eastern part of the Sahara, and has long been celebrated for the oases, or small scattered spots, where a natural spring of water has permitted scanty herbage and the date-palm tree to grow in the midst of the waste of hot sand, where all nature is as silent as the grave.

The size of the desert is very great. It occupies 2,500,000 square miles. It is therefore nearly two-thirds of the size of the whole of Europe. Its breadth is as great as the distance from the south-west of Ireland to the Ural Mountains, that divide from Asia; and crossing the desert from the Atlantic to the Nile would be the same thing as travelling across Ireland, England, Belgium, Prussia, and Russia, were those countries without a cultivated field, a river, a branching tree, and a road. The North Cape may readily be found on the map, and a line may be drawn from it to the river Danube. This is a distance of 1,000 miles, or thereabouts, and is the same as that which has to be traversed when caravans cross the desert. Imagine a series of plains and low hills extending the distance of from the north of Scotland to the south of Spain, all without a track upon them, having wells sometimes 200 miles apart, and without a blade of grass, and there is not much difficulty in believing the Sahara to be deserted, or, as it is termed, a desert. Many small streams flow from the Algerian mountains southwards towards the desert, but they are soon lost in the sand. On the other side of the desert, the Senegal, and the river at Timbuctoo, run parallel with the Sahara, but do not send any waters into it; and far away to the east the same thing is observed as regards the Nile. It is a well-established fact that 2,600 miles of desert may be traversed without crossing a stream. There is dry sand, rock, and stone in abundance; but they are not covered with mould, and without this nothing can grow. The sand is often very dust-like, and the slightest breeze keeps the top of it on the move. It puffs upwards in the traveller's face as he walks, and irritates the eyes and skin. A gentle gale moves the sand in low clouds, and waves of it are formed to be destroyed and scattered about hour after hour. No road can be distinguished, on account of this constant movement of the sand; and the dead and dying, which the caravans leave behind, are soon covered up. They may remain under the sand until, during some terrific wind-storm, succeeding travellers hurrying on amongst the deluge of sand see them white and fleshless, and are warned of their own danger.

The wind is the thing to be feared on the desert, and the heated soil, the absence of moisture, and the vast extent of the surface, where there is nothing to break the force of a moderate gale, combine to make its effects very terrible. Whirlwinds rush over the sand and twist it up into gigantic columns, as seen in the accompanying engraving, and they are surrounded with clouds of dust hurrying on in the direction of the storm. The columns of sand are often many yards in height, and they move like waterspouts at sea. Woe to the caravan or the camp they overtake! for those that are not killed by the weight of the sand poured over them, are liable to be suffocated by the dust and the hot wind.

The hot wind is not always accompanied by sand-storms, but a steady breeze blows over the desert, whose surface is at noonday at a temperature of 110 to 120 deg. Men become hot, their breathing increases in rapidity, and the pulse beats with violence; thirst of the most terrible kind ensues, and great exhaustion. As the traveller lies panting, his tongue swollen, his skin clammy, and his courage sinking, there appear on the horizon, far away over the sand, a few tall trees, whose



SAND-STORM ON THE SAHARA.

he knows must cover a well. He rises, and then a calm lake meets his eye, and, as he moves onwards, long ranges of forest and plain greet him. It is not his imagination, for his fellow-travellers the grand scene; they see the same objects. Yet there is no water there, and the date-palms are waving hundreds of miles away. This is called the mirage. It is something to think about, for it is not a delusion of the eye, but of the mind reflecting upon what it sees. It is the wonder of the desert, and it is seen by the seaside as well. The Sahara looks like a great dried-up sea with a sandy bottom, and that is what it really is. For in the midst of the desert sea-shells of kinds now living in the Atlantic Ocean and Mediterranean Sea are found, and in considerable quantities. Their inhabitants died when the Sahara rose up and became dry land; when the deep sea, with its moist gales, became a rainless, hot desert. This elevation of the Sahara is supposed to since the creation of man, and geologists that it altered the climate of Southern Europe. At one time the glaciers of the Alps came down to near the Mediterranean. Owing to some cause they retreated to their present po- but they left their mud and waste to prove their former magnitude. It has been proved that when there is a hot wind blowing over the desert from south to north, a warm current of air passes over the sea and reaches the Alps. The effect of is to dissolve the ice and snow on their tops at a great rate, and it is supposed that the hot blasts which occurred when the sandy Sahara succeeded the cool sea produced enormous alterations in the by dissolving their ice and by preventing

Although the surface of the Sahara is so arid and waterless, because of there being no rainfall, and of the sandy nature of the soil and the rocks beneath, there is plenty of water deep down. The French have sunk artesian wells here and there, and plenty of pure fresh water pours up through them, irrigating the surrounding districts and producing fertile spots.

The tribes inhabiting the desert are not numerous. Those on the south are agricultural, and send gums and salt to market down the Senegal. Those in the Libyan desert are wanderers, and depend upon the water and pasture of the oases. On the north there are plundering Arabs, and those who form the guards of caravans. The camel is their "ship of the desert," and its wonderful capacity for travelling a long time without drinking appears to qualify it in a most singular manner for the use of men living in such a miserable country. There are other in the world, but none equal the Sahara. There is a great desert in the far west of North America; the desert of Arabia is a vast country; that to the east of the Indus is as large province, and Australia has large sandy tracts.

BURIAL ALIVE.

Augustinian monastery of Thorn Humber, in Lincolnshire, was founded in that church-building age, the twelfth century, by William le Gros, earl of Albemarle, and lord of Holderness, grandson of Odo, earl of Champagne, one of the followers of the Conqueror, and distinguished among the Anglo-Norman barons for his liberality towards the religious orders. He is recorded as "an eminent founder of monasteries," and Thornton Abbey was the first in point of date of his establishments in England. It was founded in 1139, the fourth year of King Stephen, and for many years the buildings were of a temporary nature. It was afterwards rebuilt with great care, the church alone being in progress nearly two centuries. The only part which remains at all in a perfect state is the entrance gate-house, one of the finest in existence in any part of England. This is in the perpendicular style, and was built soon after the sixth year of Richard II. (A.D. 1382). Many of its details are extremely beautiful. The abbey was yet flourishing in the early part of the sixteenth century.

A curious discovery was made more than a century ago, during some excavations near the chapter-house. It was first mentioned by Stukeley, who visited the ruins in 1722: he says that "upon taking down an old wall there they found a man, with a candlestick, table and book, who was supposed to have been *immured*," that is, walled in. Tradition has always asserted it was an abbot who suffered this punishment, and it may be worth while to inquire how far popular belief is in this case correct. Two of the abbots of Thornton were doubtful reputation. Thomas Gretham, the fourteenth abbot, was deposed in 1393. The author of a MS. History of Thornton gave him so bad a character, that a possessor of the work, in the last century, tore out a leaf containing an account of his abbacy, "to prevent," says Farmer in a note to the volume, "scandal to the Church." Thus, in the absence of this leaf, we are compelled to rely upon the next suspicious entry in the book. Speaking of Walter Multon, eighteenth abbot, the writer says, under the year 1443, "he died, but in what manner or by what death I know not. He hath no obit, as the other abbots have, and the place of his burial hath not been found." It is almost impossible to doubt that this significant passage has allusion to the fate of Walter Multon, who expiated his unrecorded offences by suffering that dire punishment which, we have reason to believe, the secret and irresponsible monastic tribunals of the middle ages occasionally inflicted upon their erring brethren.

We may here add that the skeleton thus *immured* was found several years ago, at Coldingham Abbey. Another instance was discovered about 1845, at Temple Bruer, in Lincolnshire.

PHOSPHORUS FIRST MADE IN ENGLAND.

UNTIL the year 1863 there flourished in Southampton Street, Covent Garden, the establishment of Messrs. Godfrey and Cooke, noted as the oldest chemists and druggists' shop in London, and reputed for the excellence of the drugs and chemicals there sold. Here phosphorus was first manufactured in England, the premises having been the house, shop, and laboratory of Ambrose Godfrey Hanckwitz, who, immediately after the discovery of phosphorus by Brandt, the Hamburg alchemist, under instruction from the celebrated Robert Boyle, succeeded in producing an ounce of the substance, and presented it to his master. Boyle's account of it and his experiments caused a demand for phosphorus, and Hanckwitz, working under Boyle's direction, commenced to manufacture it, and produced it in larger quantities than any other person. In his advertisement he says, "For the information of the curious, he is the only one in London who makes inflammable phosphorus, which can be preserved in water. Phosphorus of Bolognian stone, flowers of phosphorus, black phosphorus, and that made with acid oil, and other varieties. All unadulterated. Every description of good drugs he sells wholesale and retail. N.B.- He sells solid phosphorus wholesale, fifty shillings an ounce, and retail, three pounds sterling the ounce."

Bedford House was taken down in 1704, and Southampton Street was then commenced building. Here, in 1706, Hanckwitz built his premises, the business of a chemist having been carried on by him in the neighbourhood since 1680. Jacob Bell, in his "Historical Sketch of the Progress of Pharmacy in Great Britain," tells us that Hanckwitz "was a maker of phosphorus and other chemicals which were rare at that period, and which he sold in different parts of the country during his travels. His laboratory was a fashionable resort in the afternoon on certain occasions, when he performed popular experiments for the amusement of his friends. It opened with glass doors into a garden, which extended as far as the Strand, but which is now built upon. Four curious old prints of the laboratory in its original state are in the possession of Messrs. Godfrey and Cooke (removed to Knightsbridge), also a portrait of Hanckwitz, engraved by Vertue (1718), which he had distributed among his friends as a keepsake."

Hanckwitz died in 1741. His successors, Godfrey and Cooke, maintained the date 1680 on their premises in Southampton Street, and inscribed over the laboratory in Maiden Lane, where the seat of the important chemical manufacture next became a potato store! We confess that we look upon this change a feeling of regret. Perchance some reader . "What care I about phosphorus?" Many a better-informed reader will remember that to the utilisation of this elementary body we owe that domestic wonder, the lucifer match, accidentally discovered by a chemist and druggist of Stockton-upon-Tees, some five-and-forty years ago, and brought into general use by the recommendation of Faraday.

The common phosphorus is derived from calcined bones, by treating them with sulphuric acid and water. Hanckwitz procured it from urine. It continued long to be an expensive chemical, for in 1731 the phosphorus used in some experiments exhibited before the Prince of Wales, and amounting to six ounces, cost ten guineas.

PARASITES.

IF a boat is anchored in any one of the channels which separate the quicksands of the mouth of the Thames, when the tide is running fast during calm summer weather, multitudes of jelly-fish may be seen floating along just below the surface. Some are no bigger than tea-cups, and others are the size of a large basin, and they all have some curious markings on the top, and move by contracting and expanding the lower parts of their bodies. Hour after hour these beautiful things float by, and their numbers are incalculable. If one is caught with the hand, the fingers usually perforate its jelly-like structure, and if it is placed on a board the creature seems to run away in the form of water. Now a great many of the larger kinds, when carefully examined, are found to have within their large stomach a small white shrimp with most beautiful emerald-coloured eyes. It was supposed that these shrimps formed the food of the jelly-fish or medusæ, as they are properly called, but careful investigations prove that these lively little creatures with the beautiful eyes only exist in the larger medusæ, and that they make the stomach of these wandering masses of animal jelly their home and larder. The shrimp soon dies if it is taken from its shelter, and specimens of it are never found swimming with the common shrimps which live in the sea around our coasts. The shrimp lives at the expense of the jelly-fish, and feeds upon some of the small creatures which are entangled by the peculiar structures of its mouth. The jelly-fish floats along collecting food, and killing every small living thing that touches its stinging body, whilst the shrimp enjoys itself and lives inside, out of danger and in great comfort. The shrimp swims in and out, and is never harmed by the deadly poison of the wonderful sharp stings of the medusa. Now the most wonderful part of this singular history is how the jelly-fish and the shrimp come together. There are no jelly-fish in the winter and early spring, and the whole of them die in the autumn, shrimps and all. Before dying the shrimp leaves the stomach

of the jelly-fish, and lays its eggs at the bottom of the shallow sea.

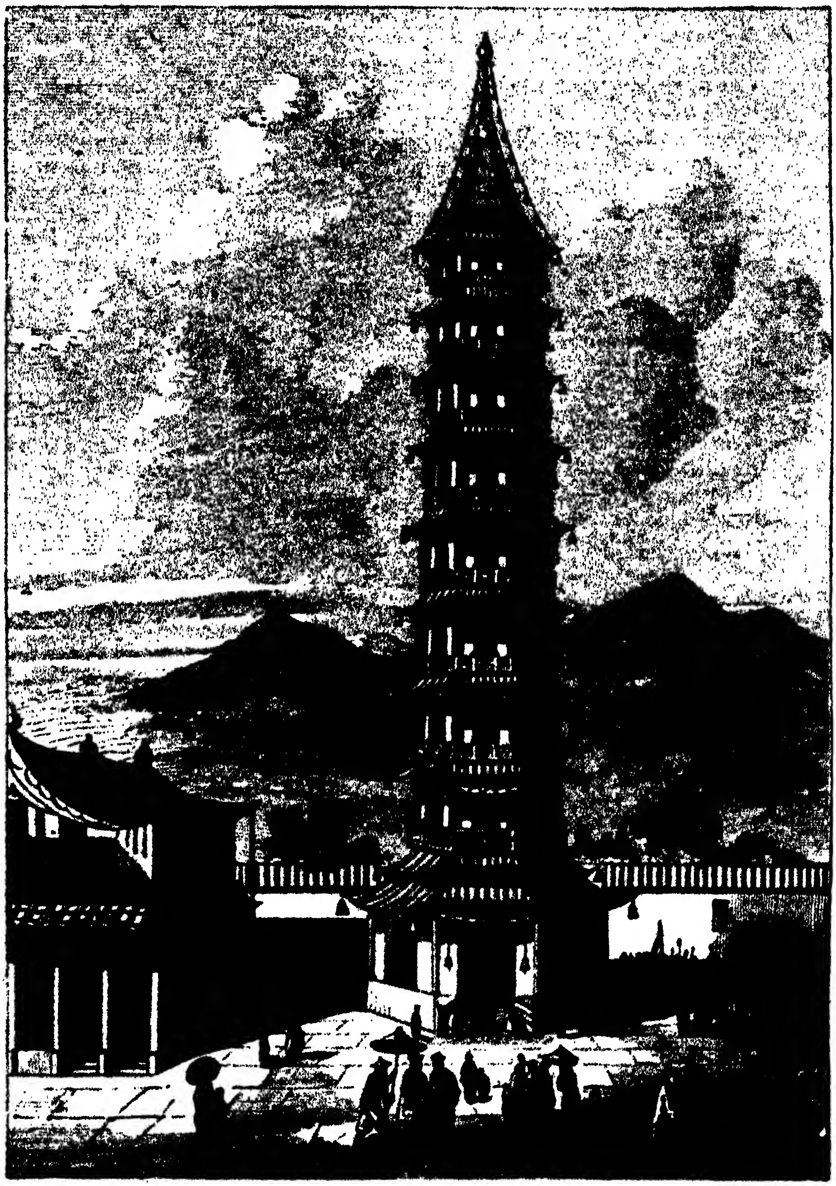
The jelly-fish lays thousands of tiny eggs, which, covered with small movable hairs, row them into quiet rocky nooks on the coast and settle down. These eggs become adherent to pieces of shell or stone, and do not turn to jelly-fishes any more than a butterfly's egg turns to a butterfly. A stem springs from them, and branches arise from it all covered with tiny cups, whose rims are crowded with small arms called tentacles. This is the first stage of the jelly-fish's life. Now the shrimp's egg hatches about the same time as the stem just mentioned begins to grow, and the young shrimp is not at all like the old one; it has a big head, a small body, and very long legs. In the first part of their existence the jelly-fish and the shrimp are separate, and unlike what they subsequently turn to. As the warm weather comes on, the stem with its branches and cup-like ends begins to bud, and after awhile out of the buds spring tiny jelly-fish, which soon swim off. About this time the young shrimp casts its skin and grows into the form of the old one, and it invariably seeks shelter in the stomach of the first young jelly-fish it comes across in its swimming to and fro. This extraordinary circle of events goes on year after year, and the reason why the young shrimp should seek an animal totally unlike itself and very fatal to other shrimps, is one of those things in nature that no one can understand. Certainly no other kind of shrimp could live in the medusa's stomach.

Some insects which are naturally very fierce and dangerous to others, submit to be despoiled of their food by very harmless creatures without resenting the injury in the least. The hive-bee is exceedingly excited if any other bee, not belonging to its company or swarm, comes near its hive; and if a wasp or a hornet should alight near the door the whole of the inhabitants come out to repel the intruder's attack. This is what every one would expect. But there is a large moth, commonly known as the death's-head moth, from its having a curious mark on its back like a skull and cross-bones sculptured on an old tombstone, which makes very free with the bee's honey. It flies in the dusk of the evening when the bees are at rest, and enters the hole in the hive, pokes its long sucker through the wax walls which surround the comb, and draws much honey into its stomach. Very often in the long evenings there are many bees lingering round about the hive, but if the death's-head alights and moves towards the door they do not take much notice; yet one sting would kill it, and it has no means of hurting the bee in return. So much troubled are some hives by these curious visitors, that the bees erect a flat wall of wax just within the hive-door, allowing a small opening to exist on either hand. This, as a rule, puzzles the moth, and it cannot enter. On the other hand, if a moth gets right into the hive the bees do not kill it, but either let it alone or use all their ingenuity to stop its honey-stealing propensities. Whilst the moth is enjoying its meal, the bees occasionally pull down some of the honeycomb behind it, and mould the wax quickly so as to form a dense wall. When the moth has finished its meal and turns to get out of the hive, it finds itself walled-up and imprisoned for life. It is very wonderful that this honey-stealing instinct should influence generation after generation of death's-head moths, for of course when it is a chrysalis and a caterpillar it knows nothing of honey. A punishment something like this occurs in the instance of a curious crab that lives in one of the kinds of coral found in the Mediterranean Sea. This crab, when the coral is young and fleshy, nibbles its way into the middle of the growing stem and feeds away in quiet. But soon the polypes on the outside of the coral begin to grow very rapidly, and they make the opening by which the crab hoped to escape so small that it cannot get out. The crab dies, and the horny part of its body positively strengthens the lower part of the coral, and it is often found completely surrounded by the beautiful little polypes. Even the human face is not spared by some really very ugly parasites, and the prettiest of noses are pestered by a remarkably disgusting-looking insect. Sometimes a very small speck comes on the skin, which is white in colour, and about the size of the point of a pin. If the little projection is squeezed a white mass comes out, and should this be placed on a slip of glass and moistened with glycerine and water, an ugly thing like a crab stirs itself about and separates from the white fatty-looking matter. It has a long body, eight legs, and a small head, and it feeds upon the white substance; and it requires a slight magnifying-glass to distinguish it. The small hairs on the face and nose have a small gland close to them where they enter the skin, whose duty is to produce the greasy matter that renders the skin soft and sometimes oily. The parasites get into this gland, and after awhile excite its powers so much that it swells out and produces too much sebaceous matter, as it is called. Then the creatures are destroyed, for even if the mass is not squeezed out of the skin, it comes out in a few days by itself.

Even the trees around us are not free from parasites. The mistletoe is a plant which grows and flourishes at the expense of the trees upon which it is found. It is always planted on the bark of particular trees when it is a small seed, and nothing else but a bird can do this. When it flowers, certain insects must carry the fertilising dust from one plant to another in order that a seed can be formed. The life of a tree parasite is thus dependent upon many other lives.

THE PORCELAIN TOWER OF NANKIN.

THE city of Nankin, once the capital of China, has for centuries been famous to the "barbarians" of the outer world for its Porcelain Tower—a relic of the splendour of its ancient days, before Pekin usurped its dignity as the seat of empire. The place is now to a great extent a city of ruins; its palaces, tombs, and monuments were long since given over to decay, and the wars of recent years have greatly increased the general dilapidation. The city proper has shrunk to one-fourth of its former dimensions, the present population inhabiting its inner portion, while the memorials of past magnificence are distributed around them.



THE PORCELAIN TOWER.*

The Porcelain Tower was built early in the fifteenth century by the order of the Emperor Yung-loh, and as a work of filial piety. It was a

monument to the memory of his mother; and he determined that its beauty should as far outshine that of any similar memorial, as the transcendent virtues of the parent, in her son's eyes, surpassed those of the rest of her sex. No expense was spared in its erection, and its total cost is estimated at more than three-quarters of a million of our own money. The work was commenced at noon on a certain day in 1413, and occupied nearly twenty years in its completion.

An idea of the appearance of the Porcelain Tower is given by our illustration, but this is peculiarly one of the instances in which pictorial representation fails to convey an adequate notion of the ficence and beauty of an object. The total height of the tower was more than 200 feet, or about equal to that of the Monument of London, and it was faced from top to bottom with the finest porcelain, glazed and coloured. It consisted of nine storeys, surmounted by a spire, on the summit of which was a ball of brass, richly gilt. From this ball, eight iron chains extended to as many projecting points of the roof, and from each chain was suspended a bell, which hung over the face of the tower. The same arrangement was carried out in every storey. These bells added much to the graceful appearance of the tower, breaking its otherwise formal and monotonous outline.

Round the outer face of each storey were several apertures for lanterns, and when these were all illuminated, we are told, in the magniloquent language of the Chinese historian, that "their light illuminated the entire heavens, shining into the hearts of men, and eternally removing human misery!" It is not difficult to imagine, however, that the appearance of the tower on such an occasion must have been beautiful in the extreme.

On the top of the tower were placed two large brazen vessels and a bowl, which together contained various costly articles, in the nature of an offering, and a charm to avert evil influences. Among these were several pearls of various colours, each supposed to possess miraculous properties, with other precious stones, and a quantity of gold and silver. In this collection, designed to the best treasures of the state, were also a box of tea, some pieces of silk, and copies of some ancient Chinese writings.

The Chinese historian to whom we have before alluded, announced to the world, in the simplicity of his heart, that this splendid monument of filial gratitude would continue to endure and teach its lesson for hundreds of generations. But alas! for foresight, and the stability of all things on earth. In the month of March, 1853, the Taeping rebels took Nankin, and sacked the place. For a long time they appear to have kept their hands off the Porcelain Tower; but at last—probably to wreak full vengeance on the Imperialists—they demolished it. This occurred in *1856*. Since that time, Nankin has been taken and retaken, both by Imperialists and rebels, and the former now hold possession of the city; but a city no longer adorned with that famous structure which was truly one of the wonders of the world.

CURIOUS FISHES.

Certain fish have been termed "sporting," from their shooting prey with great precision. "We have," says Sir Charles Bell, "a curious instance of the precision of the eye, and of the adaptation of the muscular action in the beaked chætodon, a fish which inhabits the Indian rivers, and lives on the smaller aquatic flies. When it observes a fly alighted on a twig, or flying over it (for it can shoot them on the wing), it darts a drop of water with so steady an aim as to bring the fly down into the water, when it falls an easy prey. It will hit a fly at the distance of from three to six feet. Another fish, of the same order, the *zeus*, has the power of forming its mouth into a tube, and squirting at flies, so as to encumber their wings and bring them to the surface of the water. In these instances a difficulty will readily occur to the reader: How does the fish judge of position, since the rays of light are refracted at the surface of the water? Does instinct enable it to do this, or is it by experience?"

The jaculator fish of Java is of this sporting tribe. In 1828 Mr. Mitchell saw several of these fishes in the possession of a Javanese chief. They were placed in a small circular pond, from the centre of which rose a pole upwards of two feet in height. On the top of the pole, on sharp-pointed pieces of wood, were placed insects of the beetle tribe. When the slaves had placed the beetles, the fish came out of their holes and swam round the pond. One of them came to the surface of the water, resting there; and after steadily fixing its eyes for some time on a beetle, it discharged from its mouth a small quantity of water, with such force and precision of aim as to strike it off the twig into the water, and in an instant swallowed it. After this another fish came, and performed a similar feat, and so the sport continued until they had secured all the beetles. If a fish failed in bringing down its prey at the first shot, it swam round the pond till it opposite the same object, and fired In one instance a fish returned three times to the efore it secured its prey; but in general the fish seemed very expert gunners, bringing down the beetle at the first shot. The fish, in a state of nature, frequents the shores and sides of the rivers in search of food. When it spies a fly on the plants that grow in shallow water, it swims to the distance of five or six feet from them, and then,

prising dexterity, it ejects out of its tubular mouth a single drop of water.

A few years ago, there was exhibited in Piccadilly a "talking fish," as it was called, but it was, in reality, a seal. It measured twelve feet in length, and weighed eight hundredweight. It could stand on its tail, and overtopped its keeper. It was amphibious, and was a female seal. It was stated to have been captured on the coast of Africa, on May 5, 1854, by Signor Cavana. It had a fine dog-like head, and beautiful eyes, sparkling with intelligence, showing that what you said to it was understood, and seeking to communicate its reply. It was very docile, and would dance when bidden, rolling itself with great vehemence in its bath. It could say "Mamma" and "Papa," and could call its keeper by his name—"John." It could use its fins as hands and arms, and clasp them together in the attitude of supplication. At command, it presented either the right or left hand to the keeper. Its brain cavity was large, and the brain highly convoluted, being ranked by Professor Owen in the highest of the animal brain types. It was an Antarctic species, and rare in museums. It had two rows of teeth, and was covered with fine hair. It ate nearly five-and-forty pounds of fish per day. At night it reposed on damp boards, and the species can exist for days out of water; yet this specimen did not live long.

About the same time was exhibited in Paris a seal, advertised all over France as the Neyt Soak, or *Poisson vivant*. It was about seven feet in length, and very plump and glossy. It was about five years old, and had evidently been some time in captivity, as one of its sides was rubbed bald against the tub in which it swam. It answered to the name of "Cocot," turned round in the water, raised itself to the edge of the tub, and kissed its master's cheek.

M. Dufosse asserts that facts prove Nature to have not refused all fishes the power of expressing their instinctive sensations by sounds, but has not conferred on them the unity of mechanism in the formation of sonorous vibrations, as in other classes of vertebrated animals. "Some fishes (he says) are able to emit musical tones, engendered by a mechanism in which the muscular vibration is the principal motive power; others possess the faculty of making blowing sounds, like those of certain reptiles, and others can produce the creaking noise resembling that of many insects."

The pike is reputed to be our oldest fresh-water fish: Bacon describes two, one 150 years old, and another 100. A pike, between four and five feet long, and believed to be a century old, was taken in 1865, on the Loire: in its stomach were found a double-bladed knife, a small key, and the steel snap of a purse. The fish is preserved in of St. Etienne.

PRIZE VASES FROM THE GAMES AT ATHENS.

The usual prize of a Greek athlete was a simple wreath of laurel. It was so in the great national ss at Olympia, to which competitors came at great expense, often from all quarters of the Greek world. It was only in small local games that prizes of value were given. But then the laurel wreath of Olympia was a badge which secured a national reputation. When gained once by Hiero, the king of Syracuse, he reckoned it the grand honour of his life. It was the happiest moment in the life of Philip of Macedonia, when two simultaneous events were reported to him, the prize won by his race-horse at Olympia, and the birth of his son Alexander. Successful athletes returning to their native towns, were hailed by acclamation, and hospitality and aid freely offered them. Often when an athlete had won three of the games, his township would seek the best artist they could obtain, to make a statue for him, and set it up in the market-place. But here a law interfered. He could only have an idealised statue, for the law said that the youth of the town must not look daily upon the figure of a man so imperfectly trained, as only to have won three games. The winner of all the five, the pentathlon, as it was called, was the only man who could have a true portrait statue of himself set up in public.

The games at Athens, however, were to an extent local, with far less competition. All Athenians were eligible, as the name Panathenaic shows, in whatever quarter of the world they may have gone to live; and in the case of the prize vases of which we are to speak, the winners were resident in Cyrene, a Greek colony on the north coast of Africa. Sometimes a wreath of olive was the prize, for the olive was sacred at Athens, as the laurel at Olympia; sometimes a vase of terra-cotta, or earthenware, filled with oil from the sacred olives. Very many of those vases must have been distributed in the long course of years through which the games lasted. Yet perhaps not more than a dozen of them are now known; and of these there are certainly none to rival the six specimens in the second vase room of the British Museum. They have been all found within the last three years, by Mr. Vice-consul Dennis, in excavating the tombs at Cyrene. The successful athlete had his prize vase buried with him, as the great pride of his life. His name is not engraved upon it, and we have no clue to the tenant of the grave in which it was found. That was not the form which Greek vanity took. On each of these vases are the words, "I come from the games at Athens;" and on the other side, the name of the presiding magistrate at Athens for the year, or sometimes, the name of the potter who made it. Artists generally could write their names upon their works, without any charge of vanity.

and the magistrate's name was the only means they had of expressing the year in which any event took place. They had no era at Athens, such as we have in the birth of Christ, to reckon by.

Before describing these vases more particularly, it may be well to say a word about the games at which they were won. At what precise period they instituted, is not known; they were ascribed to the mythical hero Theseus, but they had lapsed time before the year 560 B.C. About that year, Peisistratos, the head of a powerful family, whose lands lay north of Athens, had raised himself to the position of tyrant at Athens for the third time. Tyrant meant then simply a ruler without hereditary or elective right. That was the age of tyrants in almost all the Greek states, and it was always part of their clear-sighted policy to unite the people by festivals and games, the mirth of which would drown the grudge they bore. With this intent, Peisistratos established or renewed the at Athens. All Athenians were eligible competitors; but no doubt there were conditions to be fulfilled, similar to those at Olympia. A competitor would have to send in his name some nine months before, accompanied by sureties as to his having passed through the usual practice, and as to his character; for it sometimes happened, amid all the fine displays of endurance and bravery, that acts of brutality were done. As the time approached, candidates assembled in Athens and practised together; as it came nearer, crowds of strangers arrived, and the whole town gave itself over to mirth. The five contests consisted in running, leaping, throwing the disc, boxing and wrestling, which were called collectively the pankration—and chariot races. The prize in each case was, as far as we know, the same, an olive wreath, or a vase full of olive oil; and to the six specimens of the latter in the British Museum we now turn.

The shape in all cases is the same, that called *amphora*. On the face or obverse of each, is the same stiff conventional figure of the goddess Athena, in whose honour the games were held: she strides forward armed with helmet, shield, and spear, wearing a long embroidered dress called a peplos. It may here be mentioned, that in the spring of every year seven young girls were chosen to weave and embroider a new robe for the gold and ivory statue of the goddess. It was ready by autumn, and then the ceremony took place of putting on the new robe. In the border of it they used to embroider some story of her deeds, as that of slaying the giants. As an imitation of this, the rude figures on one of the vases may be taken. On the back or reverse of each, is painted the contest in which each was won. The bold and masterly drawing of those figures may be contrasted with the stiff figure of the goddess on the obverse. A curious fact connected with one of the vases is, that on the shield of the goddess are seen two figures in the act of rushing forward. It happens that those very two figures are found also on certain silver coins of Athens, and no doubt now remains that they are copied from a famous group in Athens, of the two brothers Harmodios and Aristogeiton, who died in an attempt to kill the son of the tyrant Peisistratos, and thus liberate their native town. This vase was won not before the year 372 B.C.; so long survived the feeling of gratitude to the two brothers. The columns which run up each side of the obverse represent the columns which marked the starting-place and the goal of the race-course. The cock which surmounts them in two cases, was chosen from its fighting propensities as a symbol of the qualities displayed on the course. The seated figure holding out a branch is Victory keeping the prize till it is won.

It is not so much in excellence of form and drawing that they surpass all other vases, as in the interest awakened by the fact, that each one of them was striven for after a long, laborious training, won, prized, buried with the winner, and now after more than two thousand years, disentombed, stands as a monument of a well-fought contest.

Wonders of Animal Life.

FORMS OF ANIMAL LIFE.—Humboldt estimates that the number of animals of the mammalia kind (those who suckle their young) is about 500; of birds, 4,000; of insects, 44,000; of reptiles, 700; in all about 50,000. To Europe belong 80 of the mammalia, 400 birds, and 30 reptiles. In the southern hemisphere, around the Cape of Good Hope, birds are five times more numerous than mammalia. Towards the equator, both birds and reptiles considerably increase in variety and number. It is thought by Cuvier, and other eminent authorities, that, from the many fossil animals which have been discovered, this globe formerly must have contained more mammalia than it now does birds.

THE MANTIS.—The leaf-insects are found in most very warm countries, but those from China and the East Indies are the best known. These insects are large, grotesque-looking things, uncommonly like a set of short, yellow twigs joined together by faded leaves. The limbs of the insects are long and slender, but flattened out in some places, and their bodies are either excessively slender and twig-like or are flattened and large. The colour of the insect when it is alive blends so perfectly with the tints of the surrounding leaves and boughs, that a careless observer would pass it by as a part of a plant. Hence the name of leaf-insect. The female insect here

has a large, flat body with fine, projecting edges, and when the wings, with their delicate lace-work markings, are folded over it, the whole looks like a crumpled and faded leaf. This appearance is increased by the flat, leaf-like expansions on the limbs, and by the curious markings on the fore- t of the body, which joins the hind part just as some leaves are attached to twigs having round swellings on them. The males usually have a long and slender body, and the arms start from it just as small branches do from larger ones. They remarkably quiet insects, and will remain perfectly still for a long time, and in very peculiar positions. One of the favourite positions is to let the hinder part of the body rest flat on a branch, and to elevate the long body and arms in the attitude of prayer. One kind is called the praying mantis, from its constantly putting on this curious attitude. But really it is a natural hypocrite, and if it could speak it would say, "Let us prey," instead of "Let us pray." The posture of supplication is put on to take in the little flies which are so unreflecting as to believe that the bloodthirsty creature is a cool and inoffensive leaf. The flies alight close to the mantis, or even upon it, the clasped hands relax, and, in an instant, the unfortunate little insect is seized and crushed in the grip from which there is no escape. The resemblance of some of the kinds of mantis to the surrounding foliage is so great that it not only serves to entrap prey, but it also acts as a defence for and preservative of the insect; for birds on the look-out for flies and beetles pass the faded-looking mass of leaves and twigs as unworthy of their attention. — of the leaf-insects resemble green-leaved plants, and others those which are more or less autumnal in their tint. The female mantis lays its eggs upon plants, and covers them with a glutinous case, in which they are arranged in rows very elegantly. Some of the large kinds of mantis are from four to six inches in length. The males are very pugnacious, and can be made to fight most desperately by placing them opposite each other. They lift up their bodies, and use their long arms like sabres, and squeeze and bite until one is worsted. The leaf-insect is, perhaps, the best example of natural mimicry, and this gift of nature has, of course, nothing to do with the will of the creature. The accompanying illustration will convey to the reader a general idea of this singular insect, though it is difficult without seeing an actual specimen, to appreciate its extraordinary resemblance to a vegetable production.

THE WALKING LEAF-INSECT.

THE FLYING FOX.—The flying fox is a very curious inhabitant of the forests near Moreton Bay, in East Australia. It lives in flocks, and moves generally towards the dusk of the evening, and the noise produced by the heavy flapping of the so-called wings is very singular. The flocks like quiet places, where there are large Araucarian pine-trees, with an underwood of scrub and creepers. The foxes hang in vast numbers from the ' rizontal branches of the pine-trees. When the' . is a clear space amongst the trees, an enormous number of the animals may be seen, and their noise can be heard; for directly they see anything unusual, they utter a short bark, something like the sound made by young rooks. Often every branch is crowded, and the flying foxes are seen either flapping their

wings, and holding on with their hind feet, and with their head downwards, or snarling and fighting for places. Suddenly the whole take to flight, and flap their furry, wing-like sides, and wheel around like heavy birds. Many fly with their young holding on to them. The creature is not a true fox, and there is a fold of skin which reaches from the fore to the hind legs. This is called the wing, and it enables the Pteropus, as the animal is called, to float and turn in the air.

Curiosities of Sound.

THE difficulty of transmitting sounds to a great distance arises from the sound spreading and losing itself in the surrounding air; so that if we could confine it on one side, as along a wall, on two sides, as in a narrow street, or on all sides, as in a tube or pipe, we should be able to convey it to great distances. In the cast-iron water-pipe of s, which formed a continuous tube with only two bendings near its middle, the lowest whisper at one end was distinctly heard at the other through a distance of 3,120 feet. A pistol fired at one end actually blew out a candle at the other end, and drove out light substances with great violence.

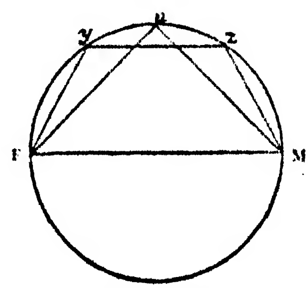
The intensity of confined sound is finely exhibited at Carisbrook Castle, in the Isle of Wight, where is a well 200 feet deep, twelve feet in diameter, and lined with smooth masonry; yet when a pin is dropped into it the sound of it striking the surface of the water is distinctly heard.

Very remarkable echoes, and some not easily credible, have been described by different authors. Several of these have been described in a previous article, but we may mention here some others equally remarkable. Dr. Plott mentions an echo in Woodstock Park, which repeats seventeen syllables by day and twenty by night.

At Roseneath in Argyllshire, when a person at a proper distance played eight or ten notes on a trumpet, they were correctly repeated, but a third lower; after a short silence another repetition was heard in a yet lower tone, and after another short interval, they were repeated a third time in a tone lower still.

In the cathedral of Girgenti, in Sicily, the slightest whisper is borne with perfect distinctness from the great western door to the cornice behind the high altar, a distance of 250 feet. By a most unlucky coincidence, the precise focus of divergence at the former station was chosen for the confessional. Secrets never intended for the public ear thus became known, to the dismay of the confessor, and scandal of the people, by the resort of the curious to the opposite point (which seems to have been discovered accidentally), till at length one had his curiosity somewhat over-gratified by hearing his wife's avowal of her own infidelity, when tell-tale peculiarity became generally and the confessional was removed.

In the whispering gallery of St. Paul's Cathedral, a low whisper uttered on one side may be distinctly heard at the opposite side of the gallery. This phenomenon has been thus explained by Dr. Paris: "M shows the situation of the mouth of the speaker, and E, that of the ear of the hearer. Now, since sound radiates in all directions, a part of it will proceed directly from M to E, while other rays of it will proceed from M to *u*, and from M to *z*, &c.; but the ray that impinges upon *u* will be reflected to E, while that which touches *z* will be reflected to *y*, and from thence to E; and so of all intermediate rays, which are omitted in the figure to avoid confusion. It is evident, therefore, that the sound at E will be much stronger than if it had proceeded immediately from M without the assistance of the dome, for in that case the rays at *z* and *u* would have proceeded in straight lines, and, consequently, could never have arrived at the point."



Another remarkable whispering gallery is in Gloucester Cathedral, though in this case the sound travels through a vaulted passage between the choir and the lady chapel.

The proportions of the stone alcoves of Westminster Bridge (removed in August, 1846), are stated to have been so accurate, that if a person spoke against the wall of either of the niches on one side of the way, he might be distinctly heard in the corresponding niche on the opposite side; even a whisper was audible in the stillness of the night.

Beneath the suspension bridge across the Menai Strait, in Wales, close to one of the main piers, is a remarkably fine echo. The sound of a blow on the pier with a hammer is returned in succession from each of the cross beams which support the roadway. The effect is a series of sounds.

The general explanation of an echo is, that it is produced by sound being interrupted by obstacles of sufficient extent and regularity. If the reflected sound meet with a second obstacle, it will be again reflected; and thus the echo may be repeated

times in succession, becoming fainter at each repetition till it dies away altogether.

Pepys, in his "Diary," 1666, notes, "Discoursed with Mr. Hooke about the nature of sounds, who told me, that having come to a certain number of vibrations proper to make any tone, he is able to tell how many strokes a fly makes with her wings (those flies that hum in their flying) by the note that it answers to in music during their flying. That, I suppose, is a little too much refined; but his discourse, in general, of sound was mighty fine."

PERUVIAN MUMMIES.

LARGE numbers of mummies are discovered in many places in Peru, and there is a tradition, confirmed by the state in which they are found, that they are often the remains of persons who were self-immolated, to escape from the inhuman cruelty of the conquering Spaniards. In an old book of Voyages, by Surgeon Lionel Wafer, who accompanied an expedition to South America in 1680, this tradition is thus corroborated: "We put ashore at Vermejo, in 10 deg. S. lat. I was one of those who landed to see for water. We marched about four miles up a sandy bay, which we found covered with the bodies of men, women, and children. These bodies, to appearance, seemed as if they had not been a week dead; but if touched, they seemed dry and light as a sponge or piece of a cork. We were told by an old Spanish-Indian whom we met, that in his father's time the soil there which now yielded nothing was well cultivated and fruitful—that the city had been so numerously inhabited with Indians that they could have handed a fish from hand to hand till it reached the Inca; but that when the Spaniards came and laid siege to their city, the Indians, rather than yield to their mercy, dug holes in the sand and buried themselves alive. The men, as they now lie, have by them their broken bows, and the women their spinning-wheels and distaffs, with cotton yarn upon them."

; desire to aid the natural powers of the eye to penetrate into distance, is by no means of recent date. History says that an instrument was placed upon the lighthouse of Alexandria by which vessels at a great distance were rendered visible: and from the probability that Archimedes employed concave mirrors for the concentration of light, it is more than likely that the Ptolemaic telescope was a *reflector*.

Without attempting a scientific description of generally, we will very briefly carry our readers along the steps which have led to the construction of an instrument capable of defining those luminous clouds which even Herschel's grand telescope utterly failed to accomplish, although could descry a cluster of 5,000 stars deeper in the abyss of space by 300,000 times than Sirius. Indeed it was Herschel's inability to resolve a certain nebula in the sword of Orion, which led that great astronomer to the conclusion, that a nebulous fluid existed in space which formed the material for future worlds.

The two kinds of telescope known as "reflecting" and "refracting," occupy distinct pages in history. Our paper has reference to a gigantic *reflector*, and we will therefore confine our remarks to that form of instrument.

It is not until 1652, that we find any mention of the use of a lens with which to magnify the reflected image, for it must not be supposed that the image of a distant object formed in the focus of the reflecting mirror is a *magnified* image; it is only rendered brighter and clearer. The [illegible] was first employed by an Italian called Zucche, in the above-named year, and was merely held in the hand and directed upon the focus of the reflector; but we may be sure the observer's head must have greatly interfered with the rays from the distant object.

In 1663, Gregory invented his now well-known telescope in which the rays are twice reflected before entering the eye-glass. The small second reflector is placed facing the large in the centre, or axis of the tube, and re-reflects the image

FIG. 1.

through a hole in the centre of the large mirror, as shown in Fig. 1

The advantage of Gregory's arrangement is, that the observer can point his instrument directly towards the object he examines, but the disadvantages are the double reflection, by which much light is lost; a further loss of light through interference of the mirror A, and the hole B light through the interference of rays at the point X.

In 1672, the great Newton, upon the day of his election as a Fellow of the Royal Society, presented the society with a reflecting telescope upon his own arrangement, and executed with his own hands. The Newtonian arrangement is shown in Fig. 2.

The large reflector, B, is entire, the concentrated rays from it being received upon the mirror A, placed at an angle of forty-five degrees to the axis of the tube, and reflected by it through an opening C, in the side of the tube.

Herschel arranged his mirror in another way. Instead of setting it so that its focus lay in the axis of the tube, as shown by the dotted line passing through A and B, in Figs. 1 and 2, he

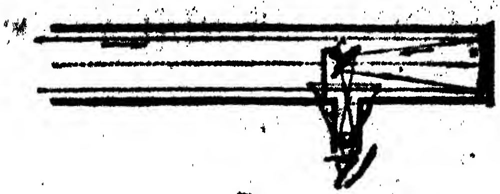
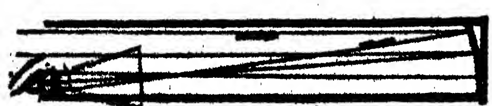


Fig. 2.

planted it slightly obliquely, as shown in Fig. 3. By this means, the focus was brought directly to the side of the tube at A without the intervention of a second reflector. The great telescope at Slough



A

Fig. 3.

is thirty-nine feet four inches long, and the reflector is four feet diameter in the clear . but its interesting history cannot now be entered into, we must pass on to a notice of the great Parsonstown six feet reflector.

To Lord Rosse belongs the credit of the whole of the ingenious arrangements, both mechanical and optical, which have characterised his wonderful instrument. The tube is constructed of wood, hooped with iron bands, and is rather over fifty-three feet long. Its lower end rests upon a massive, universal joint of cast-iron, bedded in stone-work, which is sunk deep in the ground. The tube is counterpoised to facilitate its motion, and is moved vertically, or in polar distance, by a windlass below. The horizontal motion of the telescope is limited to one hour upon the equatorial circle, which is equal to an angle of fifteen degrees, but this represents a much wider range when the tube is more vertical. This movement is produced by a wheel and pinion. The slow or delicate adjustment of the instrument, both vertical and horizontal, is under the entire control of the observer. The tube is slung by chains, which pass over the windlass underneath, and is perfectly steady even when a gale of wind is blowing. The vertical motion of the telescope is guided by a great cast-iron arc, carefully planed, forming a portion of a circle eighty-five feet in diameter, composed of pieces five feet long, each being secured to massive stone-work.

Attached to the universal joint are long indexes moving over graduated arcs, by which the direction of the tube to any desired spot is facilitated. The "micrometer," which is the system of lines intersecting the field of view, and placed there in order to measure the apparent distances between star and star, consists in this instrument of *thick* lines. They are not so accurate for celestial measurements as fine lines; but as the latter necessitate illumination to render them visible upon a dark field, the light introduced for this purpose extinguishes the faint details of the nebulæ.

Two speculæ were cast; one three and a half tons, and one rather more than four tons weight. The metal is not quite as rigid as wrought iron in the proportion of 5 to $6\frac{1}{10}$. The thickness of the material is nearly six inches. It might well be supposed that such a mass of such a material, it would be difficult, if not impossible, to bend; yet so high is the magnifying power of the mirror, that even the strong pressure of the hand at the back of it is sufficient to produce distortion in the image of a star. To secure as far as possible an even bed for it, the mirror rests upon eighty-one brass balls, carefully dispersed over the entire surface; but in spite of this precaution, the movement of the reflector, though only $\frac{1}{16}$th of an inch, produces temporary distortion. In the spring of 1848, the telescope remained unused for some time, and the result of the speculum remaining in the same position during that period was a permanent "set," producing permanent distortion. The mirror had, therefore, to be re-ground. A faint idea may be formed from these facts of the marvellous accuracy with which the surface of the speculum is ground.

It was at Christmas, 1845, that the great six feet reflector was first directed to that wonderful nebula in Orion we have already alluded to; and who shall tell the anxiety with which the result of that gaze was watched! Did nebulous fluid exist in space or not? That was the question to be solved. And solved it was. That fleecy cloud was *not* a vapour; it consisted of stars! Worlds, millions upon millions—who shall say not peopled with intelligent existences? But we cannot speculate. This gigantic telescope is, as compared with the eye, as 130,000 to 1; it has a penetrating of 500; and can render visible, stars whose would require 60,000 years to reach our earth!

THE END.

CASSELL, PETTER, AND GALPIN, BELLE SAUVAGE WORKS, LONDON, E.C.

INDEX.

PAGE

A.

Æolian Lyre, Natural... ... 154
Aerial Combats 62
Aged and Curious Trees... 103, 150
Air Hammer and Steam Hammer 91
Alexandrian Library 111
Alps, Wonders of the... ... 257
Animalcules 311, 335
ANIMAL LIFE, WONDERS OF :—
Alligators, A Lake of ... 142
Animal poisoning itself by its Town Virus 282
Ant Life, Wonders of 230, 241
Ants, White... 129
Ass, Singular Taste of an ... 27
Beetles, Muscular Power in 158
Crab, The Cocoa-Nut ... 295
Crabs Moulting 282
Elephants, Sleep of the ... 283
Elephants, White 346
Flying Fox 413
Forms of Animal Life ... 412
Gorilla, The 275
Horses, Strange 27
[illegible], Amusement of a ... 240
Mantis 412
Marine Vermin 282
Marsupials, Pouch of ... 283
Migrations of Insects ... 295
Monkeys, White 230
Natural Clothing of Animals 240
Pheasant, Maternal Instinct
Rabbits, Fecundity of ... 143
Raven, Sagacity of a ... 158
Rhinoceros, Two-Horned ... 295
Seals, Sense of Hearing in... 340
Serpents Changed into Rods 230
Solar Eclipse on Animals, Influence of 27
Spider Silk 323

PAGE

Spider, Taming a 91
Spiders in Ceylon 274
Tortoise, Gigantic 274
Trilobite 275
White Elephants ... 346
Wolf, Tame 28
Worm, Wonderful 323
ANIMAL SAGACITY, WONDERS OF :—
Camel's Revenge 200
Cats, Wonderful 46
Counterfeiting of Death by Insects 182
Dog, An Intelligent ... 46
Dogs 39
Elephants 211
Fox, Cunning of a 182
Horse, Intelligence in the . 235
Martin, Instinct of the
Newfoundland Dog, A Sagacious 182
Pointer's Contempt... . 200
War Horses 46
ANIMALS, EXTINCT :—
Deer, Great Irish 225
Dinornis and Epiornis ... 207
Dinotherium 177
Ichthyosaurus and Plesio-[illegible] ... 255
Mammoth 233
ANTIQUARIAN CURIOSITIES :—
Arch, Invention of the ... 174
Bee-keeping, Antiquity of . . 342
Blind Man's Buff, Origin of 315
Cannon, Our Ancestors' ... 84
Chronometer, The First Marine 140
Draughts and Chess in Ancient Egypt 342
High Pews, Origin of ... 315
Horse Shoe, Order of the ... 315
Inheritance, Curious Custom relating to... 342

PAGE

NurseryRhymes, Antiquity of 143
Ships, Our Ancestors' ... 252
Stale Loaf, A very 315
Sirloin Table, The 315
Sun Dial, Invention of the... 342
Superstition, Curious Ancient 378
Tobacco into England, Introduction of 378
Antipathy and Sympathy ... 47
ASTRONOMICAL WONDERS :—
Calculation, Curious ... 103
Comet, Passage of the Earth through the Tail of a ... 103
Comets 340
Gas in the Heavens, Globe of 384
Stars, Ball of 272
Stars from Earth, Distance of 211
Stars, Eccentric Movement of Fixed 290
Sun, Spots on the 323
ATMOSPHERE, WONDERS OF :—
Air Currents, Power of ... 355
Air, Spectres of the... ... 371
Aurora Borealis 262
Frost, Effects of
Mirage, The...
Rain, Black 87
Snow in the Ball-room ... 87
Snow, Red 87
Suns, Mock 12
Ulloa's Circle 12
Australian Explorers 147
Avalanches ... 270

B.

Bank Notes, Manufacture of... 302
Barbette, The Moncrieff ... 62
Bayeux Tapestry 284
Beggars' Square at Canton ... 191
Bells 89

Birds, Wonderful :—
- Butter Bird 175
- Dodo... 79
- Frigate Bird... 221
- Penguin 389
- Talking Birds ... 395
- Tribunals of Rooks... ... 250

Births, Wonderful ... 6
Bible, MSS. of 115
Black Death 50
Blunders in Art 250
Boiling Broth in the Andes ... 228
Bones, Human and Animal ... 215
Bore, The 267
Box Tunnel 298
Breathing Fire... 347
Brick Buildings, Ancient ... 382
Bricks, and extraordinary Brick Buildings 358
Bricks, Egyptian 81
Buccaneers 74

... of the Ancient World :—
- Coliseum 132
- Colossus of Rhodes... ... 110
- Mausoleum 261
- ... Golden House
- Pharos of Alexandria ... ...
- Pyramids 17
- Statue of Jupiter Olympius 200
- Stonehenge 150
- Temple of Diana of the Ephesians... 234
- Trajan's Column 180
- 100

Burial Alive ... . 40..

C.

...ations, Curious :—
- Air, Consumption of, in Activity and Repose ... 326
- Journey to the Sun .. . 103
- Labour, Value of ... 326
- Money, Interest on 326

Canning, Elizabeth, Story of ... 114
Cannon, our Ancestors' 84
Cave, Fingal's 141
Caves 144

Character, Curiosities of :—
- Business, A Man of ... 335
- Methodical Man 335
- Perfection of Politeness .. 335

Chatterton, Story of 55
Chevalier d'Eon, Story of .. 23
Chinese Women, Small Feet of 25..
Cirknitz, Lake of 90
Clothing, Fire-proof ... ... 2..2
Coffee, Curiosities of 379
Cold of Canada 396

Colorado 209
- Effect of Climate on 190

Combats, Aerial 62
Constantinople, Palace of Waters at 158

... of :—
- Alhambra 87
- Caves of Elephanta 293
- Colossal Statue of Bavaria . 367
- Eddystone Lighthouse ... 166
- Ehrenbreitstein 126
- Escurial 149
- Model of the Earth 274
- Pisa, Leaning Tower of . . 61
- Porcelain Tower of Nankin 409
- St. Mark's at Venice . . 309
- Silver Fountain, Gigantic ... 247
- Strasburg, Great Clock at ... 15

Copper 275
Coral Animals... 76
Coral Formations 145
Coronation Stone at Kingston 196

Courage, Wonders of :—
- Endurance of Physical Pain 210
- Extraordinary Coolness under Fire 210
- Fortitude, A Father's ... 210
- Hartley's Coolness at ...raltar 90
- Winkelried at Sempach ... 97

Crowns 306
Crown, Attempt to Steal the 260

Customs, Curious :—
- Beating the Bounds... ... 35
- The Freedom of Alnwick .. 223
- The Grace Cup 223

Cyclones 299

D.

Dead Sea 349
Delusion, Optical 11
Devoe, Richard, Story of ... 67
Diamond Mill 307
Diamond-Washing in Brazil ... 186

Diamonds, Stories of :—
- Koh-i-noor 26
- Pitt Diamond 268
- Sancy Diamond 198

Digestion, Wonders of ... 13
Dissection of the Bible ... 27
Divining Rod 283
"Domesday Book" 237
Dreamland, Wonders of . . 42

E.

Earth Eaters 155
Earthquakes 65
Echoes ...
Eggs, Gigantic

Eel, Electrical 196

Electricity, Wonders of :—
- Induction Coil 295
- The Electro-Magnet... 2, 31
- Electricity a Motive Power 248

Electric Telegraph :—
- Needle Instrument 71
- Recording Signals 47

Emotion, Effects of :—
- Death from Joy 280
- Hair Whitened by Grief 280
- Idiotcy produced by Emotion 135

- Atlantic Telegraph ... 391
- Atmospheric Railway ... 343
- Expanding Model of a Man 130
- Great Eastern 102
- Hydraulic Press . . . 183
- Mountain Railways... . . 136
- Pneumatic Despatch .. 374
- Railways, Progress of ... 403
- Steam building 403
- Tunnel through Mont Cenis 116

Escape, A Wonderful .. . 342
Escapes of MSS. 237
Esquimaux Life, Curiosities of 375
Exhalations, Poisonous ... 301

F.

Fahlun, Miner's Corpse at ... 75
Faki... . . . .
Fireballs 68
Fire of London 330
Fire, Power of Resisting .. 127
Fire Syringe 204

... Wonderful :—
- Catfish, Double 96
- Change of Colour in ... 242
- Curious Fishes 410
- Flying-Fish 168
- Fishing-Frog 125
- Mollusca or Musical Fish ... 156
- Pike, Gratitude in 172
- Pilot-Fish 242
- Sea Porcupines 397
- Shooting-Fish 242
- Sword-Fish 144
- Tench, Voice of 172
- Travelling Fish 377
- Whale, Power of the ... 96

Fleas, Educated 131
Floating Islands 363
Flying Machines 265
Food and Animal Connection between ... 359
Fossil, Earliest... 131
Frost, Effects of 80
Frost, Preservative Properties of 80
Frosts, Remarkable 22

PAGE

G.

GEOLOGICAL WONDERS:—
Coal 279
Chalk 219
Inside of the World 303
Sand, a Grain of 179
Terraces 282
Umbrella Stones 165
Geysers 44
Glaciers... 108
GLASS MAKING:—
Bohemian Glass .. 308
Curiosities of Glass-making 190
Glass-blowing Extraordinary 142
Venetian Glass ... 202
Goat, Dexterity of a 110

H.

Heat, Application of . .. 195
Heat, Latent 214
Heat, Power of Enduring extreme 166
Heidelberg, the Great Tun of 73
Highwaymen, Curious Stories of 69
Heads, Speaking 137
Horizontorium . . . 57
Horology, Wonders of ... 258
Horse, Arabian .. 207
Human Body, Wonders of 30, 348
HUMANITY, WONDERS OF:—
Cannibalism 30
Clarke, John, the Posture Maker 82
Daniel Lambert 30
Dwarfs 387
Force of the Muscles .. 30
Giants 33
Haystack, Lady of the ... 134
Human Spiders 402
Man with the Iron Mask .. 41
Men with Tails 206
Queen of the Gipsies ... 99
Restoration of Animal Life 82
Skeleton, the Living ... 19
Spotted Boy 30
Water, a Man who lived Twenty Days on 82
Wild Man in London ... 30

I.

Ice, Leeches in 80
Identity discovered by Flash of Gunpowder 183
Imagination, Wonderful Effects of 111
IMPOSTORS:—
Joanna Southcott 118
Impostors, Wonderful ... 351

PAGE

Inscription, Wonderful ... 100
INSECTS:—
Butterflies 337
Boring Insects 309
Destructive Power of Worms 170
Gadflies 208
Garden Spider 146
Larvæ, Voracity of 67
Locusts 263
Luminous Insects . . 7
Parasites 367, 407
Wasps .. 356
Wonders of Insect Life 287, 352
Introduction 1
Invisible Girl 395

J.

Jugglers, Indian 324

L.

Lake Dwellings 94
Lake, Pitch, of Trinidad 113
Land Slips and Mountain Slips 123
Lawsuit, A Wonderful . 402
Leeches attacking Travellers . 178
Life, A Wonder of 28
Light, Wonders of, 151, 175, 191, 201
LITERARY WONDERS:—
Book Fish . . 7
Early MSS. of the Bible ... 115
Minute Writing 7
Value of in Ancient Times... 115
Locks and Keys 300

M.

Mania, Tulip 123
Mascaret, the 132
Massacre of St. Bartholomew 394
MECHANISM:—
Automata 50, 59, 222
Calculating Machine ... 266
Coach, A Fairy 99
Expanding Model of a Man 130
Jewellery, Wonderful ... 131
Lace Mechanism 266
Magneto-Electric Light 267
Measuring Machines, Whitworth's 99
Minute Workmanship ... 163
Table-clock 50
Printing 267
Speaking Machine 50
Steam-Engine 266
Stereoscope 267
Thin Sheets of Iron... ... 98

PAGE

MEDICAL WONDERS:—
Disorder, A Wondrous ... 375
Italy, Medicine in, Two Hundred Years Ago ... 390
Lost Voice, Remarkable Recovery of 135
Poison, Wonders of ... 398
St. Vitus's Dance 170
MICROSCOPE, WONDERS OF:—
Microscope, The Most Perfect... 78
Microscopic Results ... 78
MIND, WONDERS OF:—
Heinecker's Precocity ... 4
Memory, Wonderful ... 95
Mezzofanti, Memory of . 4
Monetary Wonders . 71
Muscular Exertion, Feats of 5
MUSICIANS, PRECOCITY OF:—
Crotch, William 5[illegible]
Mozart . [illegible]
Wesley, Charles 51

N.

Napoleon's March to Moscow 186
NATURAL HISTORY:—
Animal Life at great depth in the Sea 318
Ape's Nest 318
The Aye Aye 20
Cockatoo, A Wonderful . 383
Crows, Filial Piety of .. 12
Elephant 60
Dodo.. 79
Fecundity of Life in the Sea 79
Floating Snail, A Wonderful 318
Hunter's Collection of Animals 11
Moles, Voracity of .. 384
Musical Mice 100
Power of the Whale ... 96
Recognition of Voice between Ewe and Lamb . 100
Spider's Web 186
Tarantula Spider 227
Variety of Birds in West Africa 383
Waterton, Story of 318
Niagara, Stoppage of the Falls of 391
Nile, Rising of... 105
Numbers, Wonderful . 19, 54, 58
Numeral Figures, Origin of ... 75

O.

OCEAN, WONDERS OF:—
Barnacles 385
Deep Sea Sounding ... 58
Frozen Sea, A 69

OCEAN, WONDERS OF (*continued*):—
Gulf Stream 370
Maelstrom 254
Nautilus 119
Pearl Fisheries 193
Portuguese Man-of-War ... 119
Saltness of the Sea 355
... ... 35
Sea Cucumbers 304
Sea Dust 31
Sea Nettles 49
Sponge 215
Opium Eating 313
Orrery 122

P.

Palissy, the Potter 278
Panics 378
Peruvian Mummies 415
Peter Botte Mountain... ... 169
Photography, Wonders of 82, 106
Pictures in Stones 354
Pilgrims Bathing in Jordan ... 212
POISONING, CURIOSITIES OF:—
Italian Poisoner ... ...
with Thumb nail 230
Pompeians, the Disinterred ... 179
Prejudice, a Wonder of ... 218
Pride, a Wonder of 254
Prize Vases from Athens ... 411
Pyramid, the Second 287

R.

Rainfalls, Heavy, and their Causes 285
Relationship, a Wonder of ... 6
WONDERFUL:—
known Fossil ... 131
Harp of Brian Boru... ... 107
Mummies 360
The Oldest Human Relic in the World... 81
Prices given for 107
Rivers, Wonderful ... 347, 380
Rotation 305

Salinas of Iviza 259
Salt Mines of Cracow... ... 332
Sahara, The 404
SAVAGE LIFE, CURIOSITIES OF:—
Amazons of Dahomey ... 386
Bee Hunting by Natives of New South Wales ... 363
Ceremony among Savages ... 190
Esquimaux Daring 380
Tahitans, Ingenuity of ... 362
SCIENCE, WONDERS OF:—
Burning Lenses and Mirrors 366

PAGE
Danger of Chemical Experiments 398
Density of Bodies at Different Depths
Dew-fall of a Year 398
Diffusion of Powerful Odours 278
Divisibility of a Grain of Gold 331
Earth's Centre, The ... 331
Gun-cotton 302
Human Electricity 398
Life-Preserving Apparatus... 398
Light of the Sun 331
Magnesium Light 346
Magnetic Mountain... ... 279
Motion of Waves 331
Nitro-glycerine ... 347
Phosphorus first made in England 407
Plymouth Breakwater ... 346
Prince Rupert's Drops ... 382
Reflection of Sound ... 347
Sensitive Flames 250
Spectrum Analysis 231
Speed of Sound 346
Spontaneous Combustion
Telescope, Lord
Velocity of Light 279
Vibrations of the Air ... 331
Wonders Revealed by Modern Science 302
SHIPWRECKS:—
"Birkenhead," Loss of ... 86
"Kent," Loss of 291
WONDERFUL:—
Fish, Showers of ... 43, 44
Toads and Ice, Showers of...
SKY, WONDERS OF THE:—
Afterglow in Egypt... ... 254
Extraordinary Light ... 254
Lunar Phenomenon... ... 254
Table-cloth at the Cape ... 254
Sleepers, Extraordinary 122, 220
Snake Charmers 195
Snow, Wonders of 63
Somnambulism 139
Sounding Stones and Speaking Heads 137
Audible in the Night... 294
Sound Forms 273
Sound, Power of 359
Speaking Machines ... 50, 334
Speaking Trumpet 235
Wonderful Echoes 414
STATISTICS, CURIOUS:—
Arithmetic Books, Number of 67
Climate in Siberia 67
London Charities 67
Picture-dealing, Curiosities of 111
Railway Mania in 1845 ... 111

PAGE
Size of Atlantic Waves ... 67
Wealth of Tippoo Sultan... 111
STEAM POWER, CURIOSITIES OF:—
Glass Blowing Extraordinary 142
Steam and Human Body Compared... 142
SUPERSTITION, WONDERS OF:—
Elixir of Life 339
Flying Dutchman 26
Philosopher's Stone... ... 78
Proofs of Guilt in Superstitious Ages 70

T.

Temperature, Wonders of ... 227
Thames, A Whale Caught in... 22
Thugs 238
Thunder 319
Throne of the Shahs of Persia 289
Tide, A Wonderful ... 151
Torture ... ...
Trade Winds 163
Trees, Aged and Curious 103, 150

V.

Vase, Portland, Story of
VEGETATION:—
Banyan Tree 399
Barometz, or Tartarian Lamb 209
Caoutchouc 271
Castle Trees of South Africa 178
Coal Forest 316
Compass Plant 292
Deadly Plant 139
Di ea 204
n Tree 401
Eve's Apple Tree 126
Floating Island on Derwentwater 38
Food of Plants 393
Germination of Seed Long Buried 38
Gigantic Trees of California 271
Green Rose 38
Hunger Plant 140
Hygrometers, Natural ... 292
Itch-Wood Tree 388
Ivory Plant 281
Lattice Plant 329
Lemon Grass of Ceylon ... 178
Luminous Vegetation 46, 188
Minute Plants 249
Mountain Cabbage Tree ... 162
Oldest Rose Tree in the World 127
Rafflesia 159
Rice Paper Plant 297

PAGE

Seeds of Mushrooms and Toadstools 361
Snake Nut 163
Tenacity of Vegetable Life... 102
The Smallest Flowering Plant 345
Thistles of the Pampas ... 39
Toadstools, Resistless Force of Growing 326
Trees, Falling in Primeval Forests 39
Trees struck by Lightning... 271
Tropical Vegetation ... 92
Upas Tree 223
Vegetables, Wonderful ... 25
Weed, a Wonderful ... 121
Welwitschia 173
Yeast, a Plant 40
Vehmgerichte 246
Vendetta 307
Volcanoes ...188, 217, 242, 321

W.

Watch found in a Shark .. 375
WATER:—
Diversity of Colour in ... 366
Expansive Power of ... 339
The Heaviest 320
Waterfalls 236
Waterspouts 229
Wells and Hot Springs ... 353
Wind, Effects of Violent ... 240
WOMEN, WONT
Davis, Christiana 9
Grace Darling 153
Heroism of a 30
The Female Pirates... .. 37
Wood-carving by New Zealanders 212

Y.

Yard-measure 310

ILLUSTRATIONS.

PAGE

Anacharis alsinastrum ... 121
Animalculæ ... 312
An Ant-hill ... 241
Ants, White, and their Dwellings ... 129
Artesian Well ... 353
Aurora Borealis ... 185
The Aye Aye ... 21
Banyan Tree ... 400
Barnacles ... 385
Barometz, The ... 269
Bayeux Tapestry ... 284
Bell, Great, at Moscow ... 89
Bicycle Velocipede ... 305
Birds' Nests ... 276, 277
Boring Insects, Ravages of ... 369
British Lemnas ... 345
Cannon, Our Ancestors' ... 84, 85
Cañons of the Colorado ... 209
Carved Monument in New Zealand ... 213
Catfish, Double ... 96
Climbing Perch ... 377
Coal Forest ... 317
Coliseum, Ruins of the ... 133
Comets ... 340, 341
Coral Animals ... 76, 77
Dead Sea ... 349
Diatoms in the Microscope ... 249
Dinotherium, Skull of ... 177
— ... 205
Dragon Tree of Orotava ... 401
Drilling Machine used at Mont Cenis ... 117
Earth Pillars of Botzen ... 165
Effect of Eruption of Vesuvius on the Sea ... 321
Elephanta, Entrance to Caves of ... 293
Eruption of Vesuvius ... 217
Escurial, View of ... 149
Falls of the Zambesi (*to face*) 236
Fata Morgana ... 372
Female Pirates, The ... 37
Fingal's Cave ... 141
Fishing Frog ... 125
Floating Raft on the Mississippi "
Flying Fish ... 168
Flying Machine ... 265
Food of Plants ... 393
Forest Scene in South America 93
Frigate Bird, The ... 221
Frozen Sea, Scene on ... 69
Fungi, Minute ... 361
Geysers in Iceland ... 44, 45
Glaciers ... 108, 109
Grace Darling ... 153
Gymnotus, or Electrical Eel ... 197
Hall of the Abencerrages ... 88
Heidelberg, Great Tun of ... 73
Horizontorium ... 57
Indian Fakir ... 161
Indian Jugglers ... 325, 326
Ivory Plant ... 281
Lagoon Island ... 145
Lantern-Fly, The Great ... 8
Lattice Plant ... 320
Leaning Tower of Pisa ... 61
Lisbon after the Earthquake ... 65
Locks and Keys ... 300, 301
Mammoth Cavern in Kentucky 245
Mammoth, Discovery of the ... 233
Man with the Iron Mask ... 41
Mausolus, Tomb of ... 201
Migratory Locust ... 264
Mock Suns ... 13
Mummy Case 360
Nilometer ... 105
Oldest Human Relic ... 81
Oliver Cromwell's Porter ... 33
Opium Smokers ... 313
Pearl Diving ... 193
Penguins ... 389
Pepper's Ghost ... 201
Peter Botte Mountain ... 169
Pitch Lake of Trinidad ... 113
Porcelain Tower of Nankin 409
Portrait of the Chevalier d'Eon 24
Portrait of Old Parr ... 29
Portuguese Man-of-War ... 420
Pyramid, The Great ... 17
Rafflesia Arnoldi ... 160
Rice Paper Plant ... 297
Rotifer, The, or Wheel Insect 336
St. Mark's at Venice ... 309
Salt Mines of Wieliezka ... 333
Sand Storm in the Sahara ... 405
Sea Cucumber ... 304
Sea Nettles ... 49
Sea Porcupines ... 397
Sempach, Battle of ... 97
"She had to Fight a Duel with a Rival" ... 9
Shell of the Pearly Nautilus ... 120
Ships of War (Ancient) ... 253
Skeleton of the Dinornis ... 208
Skeleton of the Great Irish Deer ... 225
Skeletons of Plesiosaurus and Pterodactyl ... 256
Spectral Ships ... 373
Spectre of the Brocken ... 53
Sponge ... 216
Statues of Memnon ... 137
Stonehenge (restored) ... 157
Strasburg Great Clock 15, 16
Swallow-tailed Butterfly ... 337
Sword-fish ... 144
Throne of the Shahs of Persia 289
Topham's Great Feat ... 5
Torture, Instruments of 364, 365
Trajan's Pillar ... 181
Tree Wasp, Nest of the ... 357
Tsetse Fly ... 288
Ulloa's Circle ... 12
Upas Tree, The ... 224
Uriconium, Excavations in ... 101
Vegetables, Wonderful ... 25
Volcano in Java ... 189
Walking Leaf-Insect ... 413
Waterspouts at Sea ... 229
Welwitschia mirabilis ... 173
Wetterhorn, View of the, from Rosenlaui ... 257
Yeast Plant, The ... 40

DIAGRAMS.

Action of the Geyser ... 46
Atlantic Cable ... 392
Atmospheric Railway ... 344
Balls of Stars ... 272
Britannia Bridge ... 328
Construction of the Pyramids ... 17
Echoes ... 414
Electricity as a Motive Power 248
Electrical Organs of the Gymnotus ... 197
Electric Telegraph 47, 48, 71, 72
Frost, Effects of ... 80
Globes of Gas ... 384
Heat, Power of Resisting ... 128
Hydraulic Pressure, Wonders of ... 183, 184
Induction Coil ... 296
Light, Velocity of ... 192
Light, Wonders of ... 176
The Magnet ... 3, 4, 31, 32
Optical Illusion ... 11
Snow Crystals ... 64
Sound Forms ... 273
Spectrum Analysis ... 232
Telescope, Lord Rosse's 415, 416
Waves of Light ... 152

STANDARD WORKS.

The Family Physician. A Manual of Domestic Medicine. By Physicians and Surgeons of the Principal London Hospitals. Complete in One Vol., 1,048 pages, royal 8vo, 21s.

The French Revolutionary Epoch. A History of France from the beginning of the First Revolution to the end of the Second Empire. By Henri Van Laun. Two Vols., 24s.

The King's Secret. By the Duc de Broglie. Being the Secret Correspondence of Louis XV with his Diplomatic Agents, from 1752 to 1774. Two Vols., cloth, 24s.

The English Army: Its Past History, Present Condition, and Future Prospects. By Major Arthur Griffiths. Demy 8vo, cloth gilt, 21s.

Armenia, and the Campaign of 1877. By C. B. Norman, late Special Correspondent of *The Times* at the Seat of War. With Maps and Plans. Demy 8vo, cloth, 21s.

Captain Burnaby's Ride to Khiva. Cheap Edition. Extra crown 8vo, with Three Maps, cloth, 7s. 6d.

Russia. By D. Mackenzie Wallace, M.A. Cheap Edition, in One Vol., 10s. 6d.; *Library Edition*, in Two Vols., 24s.

Turkey in Europe. By Lieut.-Col. James Baker. 560 pages, demy 8vo, with Coloured Maps, cloth, 21s.

Egypt as It Is. By J. C. McCoan, late Editor of the *Levant Herald*. With Coloured Map. Demy 8vo, cloth, 21s.

The Great Thirst Land. A Ride through Natal, Orange Free States, Transvaal, Kalahari. By Parker Gillmore ("Ubique"). *Cheap Edition.* With Map. Cloth, 7s. 6d.

New Greece. By Lewis Sergeant. An Account of the Establishment and the Actual Condition of the Hellen Kingdom, showing the Responsibilities and Obligations of England, and her Interest in the Further Development of the Country. Demy 8vo, with Two Maps, 21s.

Science for All. Vol. I. Edited by Dr. Robert Brown, M.A., F.R.G.S., &c., assisted by Eminent Scientific Writers. Vol. I contains about 350 Illustrations and Diagrams. Extra crown 4to, cloth, 9s.

Russo-Turkish War, Cassell's History of. Vol. I. By the Author of Cassell's History of the Franco-German War. With about 300 Illustrations, Plans of the Battle-fields, &c. Extra crown 4to, cloth, 9s. (*To be completed in Two Vols.*)

England, Cassell's History of, from the Earliest Period to the Present Time. New Toned Paper Edition. With about 2,000 Illustrations. Post 4to, 5,500 pp. Complete in Nine Vols., bound in cloth, 9s. each. *The Volumes can be had separately.* Library Edition, bound in brown cloth, with gilt tops, £4 10s.

British Battles on Land and Sea. By James Grant, Author of the "Romance of War," &c. With 600 Illustrations. Complete in Three Vols., extra crown 4to, cloth, £1 7s.

War between France and Germany, Cassell's History of the. Complete in Two Vols., with about 500 Engravings and Plans of the Battle-Fields. Extra [illegible] 18s.

United States, Cassell's History of the. By Edmund Ollier. Complete in Three Vols., containing 600 Illustrations and Maps. Extra crown 4to, cloth, £1 7s.

India, Cassell's History of. By James Grant, Author of "British Battles on Land and Sea." With about 400 Illustrations & Maps. Complete in Two Vols. Extra crown 4to, cloth, 18s.

Protestantism, The History of. By the Rev. J. A. Wylie, LL.D. With upwards of 600 Original Illustrations. Complete in Three Vols. Extra crown 4to, cloth, £1 7s.

Old and New London. A Narrative of its History, its People, and its Places. Complete in Six Vols., with about 200 Engravings each. Extra crown 4to, cloth, 9s. each. Vols. I. and II. are by Walter Thornbury, the other Vols. are by Edward Walford.

Library of English Literature. Selected, Edited, and Arranged by Prof. Henry Morley. With Illustrations taken from Original MSS., &c. Each Vol. complete in itself.

Vol. I. Shorter English Poems. 12s. 6d.
Vol. II. Illustrations of English Religion. 11s. 6d.
Vol. III. English Plays. 11s. 6d.

English Literature, Dictionary of. Being a Comprehensive Guide to English Authors and their Works. By W. Davenport Adams. 720 pages, extra fcap. 4to, cloth, 15s.

Phrase and Fable, Dictionary of; [illegible] the Derivation, Source, or Origin of Common Phrases, Allusions, and Words that have a Tale to Tell. By the Rev. Dr. Brewer. Demy 8vo, 1,000 pages, cloth, 7s. 6d.

Household Guide, Cassell's. New and Revised Edition. A Guide to Every Department of Practical Life. With *numerous Coloured Plates*, and Illustrations on nearly every page. Complete in Four Vols., cloth gilt, price 6s. each.

Cookery, Cassell's Dictionary of. With numerous Engravings and Full-page Coloured Plates. Containing [illegible] Recipes. 1,280 pages, royal 8vo, cloth, 15s.

Domestic Dictionary, Cassell's. An Encyclopædia for the Household, containing several thousand subjects relating to the Wants and Requirements of Every-day Life. 1,280 pages, royal 8vo, half-roan, 15s.

Popular Educator, Cassell's New. Revised to the Present Date, with numerous Additions. Complete in Six Vols., 412 pp. each, cloth, 6s. each; or Three Vols., half-calf, £2 10s.

Technical Educator, Cassell's. Complete in Four Vols. With numerous Illustrations. Extra crown 4to, cloth, 6s. each; or Two Vols., half-calf, 31s. 6d.

Mechanics, The Practical Dictionary of. Containing 15,000 Drawings of Machinery, Instruments, and [illegible] in use by every Profession and Trade, with Comprehensive and Technical Description of every subject. Complete in Three Vols. super-royal 8vo, cloth, £3 3s.; half-morocco, £3 15s.

The Vicar of Wakefield, and other Works by Oliver Goldsmith. With upwards of 100 Illustrations. Super-royal 8vo, cloth, 5s.; cloth, gilt edges, 6s. 6d.

Gulliver's Travels. With Eighty-eight Engravings by Morten. Imperial 8vo, cloth, 7s. 6d.; cloth, gilt edges, 10s. 6d.

Illustrated Readings. Containing about 500 choice Selections from the English Literature of all Ages. First and Second Series. Each Series complete in One Volume. Profusely Illustrated. Cloth, each, 7s. 6d.; cloth, gilt edges, 10s. 6d.

POPULAR WORKS ON NATURAL HISTORY.

New Natural History, Cassell's. Edited by Professor P. Martin Duncan, M.B., F.R.S., assisted by Eminent Scientific Writers. Vols. I. and II. Illustrated throughout. Cloth, 9s. each.

The Races of Mankind. A Description of the Characteristics, Manners, and Customs of the Principal Varieties of the Human Family. By Robert Brown, M.A., Ph.D., F.L.S., [illegible] Containing upwards of 500 Illustrations. Complete in Four Vols., 6s. each; or Two Double Vols., £1 1s.

The Book of the Horse. By Samuel Sidney. With 25 fac-simile Coloured Plates, from Original Paintings, and upwards of 100 Wood Engravings. Demy 4to, cloth gilt, 31s. 6d.; half-morocco, gilt edges, £2 2s.

The Illustrated Book of Poultry. By L. Wright. With 50 exquisite Coloured Plates of Prize Birds, painted from Life, and numerous Engravings. Demy 4to, cloth, gilt edges, 31s. 6d.; half-morocco, £2 2s.

The Book of Pigeons. By Robert Fulton. Edited and Arranged by Lewis Wright. With 50 life-like Coloured Plates, painted expressly for this Work, and numerous Engravings on Wood. Demy 4to, cloth, gilt edges, 31s. 6d.; half-morocco, 42s.

Brehm's Book of Birds. Translated from the Text of Dr. Brehm, by Professor T. Rymer Jones, F.R.S. With upwards of 400 Engravings, and numerous full-page Coloured Plates. *Complete in Four Volumes*, 4to, cloth, 7s. 6d.; gilt, gilt edges, 10s. 6d. each.

The New and Cheaper Editions of Louis Figuier's Popular Scientific Works, containing all the Original Illustrations, the Text Revised and Corrected, price 7s. 6d. each, comprise:—

The Human Race.
The Ocean World.
Mammalia.
Reptiles and Birds.
The World before the Deluge.
The Insect World.
The Vegetable World.

The Transformations of Insects. By Prof. P. Martin Duncan, M.B., F.R.S. With 240 Illustrations. Cloth, 7s. 6d.